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THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

FIRST DAY, JUNE 4, 1931

MASSIVE HEMORRHAGIC CYST IN A WILMS TUMOR OF THE KIDNEY IN AN ADULT

JOHN H. NEFF, M.D.

From the Department of Urology, University of Virginia, University, Virginia

Solitary renal cysts have been reported with increasing frequency in recent years. Records are now available of well over three hundred cases, with the serous cysts outnumbering the hemorrhagic type about six or seven to one. That a goodly group of additional cases has never been placed on record is evident from the discussions of papers and other sources. A decade or so ago the condition was considered one of extreme rarity, but such a view is no longer tenable.

My reason for reporting the case below, therefore, is not the rarity of solitary cysts as such, but because the unusual clinical features and unexpected pathological findings in this particular case earn for it the rating of a surgical curiosity. As a matter of fact, objection may well be raised to including this cyst with the usual solitary cysts since it apparently arose from the degeneration of a mixed tumor. This origin, in the opinion of some writers, should automatically prohibit such inclusion.

CASE REPORT

A white woman, fifty-eight years of age, was admitted to the hospital December 9, 1930, complaining of "tumor of her left side." She had first noted a sense of fullness just below the left costal margin in November, 1929. Several months later she could feel a hard mass there and this slowly increased up to September, 1930. The rate of growth was then apparently much accelerated and the mass achieved tremendous size in the three months immediately preceding admission.

Gastro-intestinal symptoms developed during this latter period. Anorexia, nausea, vomiting and constipation became progressively frequent and troublesome. The least exertion caused marked dyspnea. Her disability was further aggravated by discomfort from a large umbilical hernia of twenty-five years' duration. This became tense and painful concurrently with the rapid abdominal enlargement. In Sep-

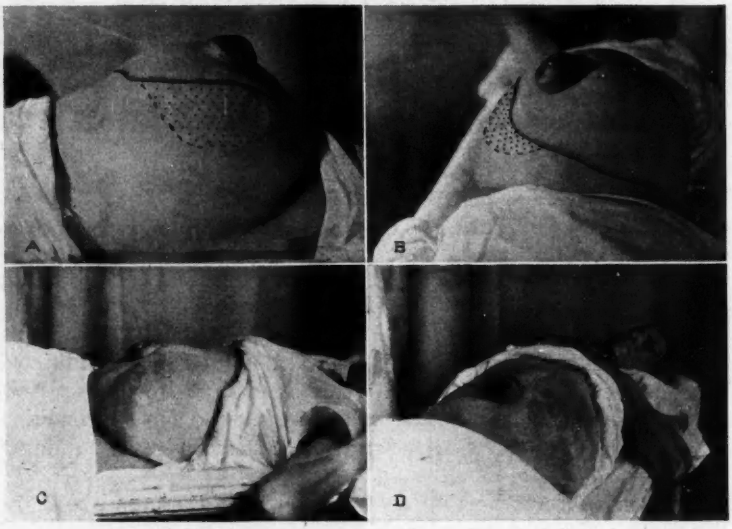

Fig. 1. *A* and *B* before aspiration and the establishment of tube drainage, *C* and *D* after aspiration and drainage. The palpable extent of the mass is outlined in *A* and *B*. The whole area was flat to percussion except where shown stippled.

tember, 1930, she began wearing an abdominal belt, but this resulted in rather extensive ulceration of the skin over the protruding hernia and was discarded. She had become practically bedridden by the time she entered the hospital.

There was no history of renal colic, hematuria or any disturbance of normal bladder function. She had been found to have diabetes in 1920, had restricted her diet for a few weeks thereafter and then resumed the family diet, seemingly without resultant ill effects.

Physical Examination.—Significant physical findings were confined to the abdomen.

The abdomen was tremendously distended by a mass arising in the left flank, but practically filling the whole cavity (Fig. 1, *A* and *B*).

This mass was smooth and tensely fluctuant in the left flank and left side of the abdomen but felt hard, solid and grossly irregular along its right border. It did not move with respiration, nor could it be moved by manual pressure. It was evident upon percussion that the intes-

Fig. 2. The left pelvis is displaced well to the right of the right pelvis.

tines were crowded into the right flank. The mass could not be felt by vaginal palpation.

The umbilical hernia had a diameter of 9 cm., projected 5 cm. above the surrounding skin, was tense as if filled with omentum and presented a large ulcer on its most prominent surface.

Laboratory reports upon admission were: blood sugar 222 mg/100 c.c., blood urea 50 mg/100 c.c., hemoglobin 78 per cent (Dare), red blood cells 3,900,000, leukocytes 11,600, differential white count normal, Wassermann and Kahn tests were negative. The catherized urine gave a reduction for sugar with one drop and a one plus acetone reading, otherwise it was negative.

Cystoscopy was performed December 12, 1930. The bladder appeared entirely normal. Both ureters were readily catheterized to the pelves. The kidney urines were pus-free (cultures negative after forty-eight hours). In fifteen minutes after intravenous injection of phthalein, output on the right was 30 per cent, on the left zero, with no leakage into the bladder. Bilateral pyelograms (Fig. 2) showed the right ureter and pelvis to be normal. The left ureter crossed to the right over the mid-portion of the sacrum and coursed upward and outward to the left pelvis, displaced 6 cm. to the right of the right pelvis and 12.5 cm. to the right of the midline. The left pelvis was strung out, moderately dilated and situated on the same level as the right. The film suggested rather extensive calcium deposit in the right edge of the mass.

The combined information from the abdominal and cystoscopic examinations permitted the diagnosis of a massive cystic tumor of the left kidney, but left the question of malignancy uncertain. Careful search, including X-ray examination of the lungs, gave no evidence of any metastases.

The rather intractable nausea, the large ulcer over the umbilical hernia, the chronic diabetes and a steadily increasing secondary anemia, rendered the care of the patient somewhat difficult. The problem was further complicated by the development of a nasty left femoral thrombosis three weeks after admission, just as healing of the ulcer was about completed. The leg and thigh became huge in size. The swelling was no doubt augmented by pressure from the abdominal mass. From admission to final nephrectomy, the patient ran a low grade fever, with the afternoon temperature averaging around 100°. The anemia at its worst gave readings of hemoglobin 40 per cent (Sahli), red blood cells 3,100,000 (February 17, 1931). The patient was carried along by frequent intravenous infusions, blood transfusions and dietary and insulin control of the diabetes until the femoral thrombosis seemed sufficiently quiescent to warrant operative work without undue danger of embolism.

Aspiration.—On February 2, 1931, seven weeks after admission, the cyst was entered far back in the left flank, first with a needle and then with a trocar and cannula. Through the latter a number 20 F. catheter was threaded for continuous drainage. Six and a half liters of chocolate-like fluid were withdrawn in the operating room and two more liters collected in the next several hours. There was no evi-

dence then or later of any fresh hemorrhage. The daily drainage, after the original large collection, averaged 100 c.c.

The removed fluid had a reddish-brown color and the consistency of chocolate. It did not clot. Test for globulin was strongly positive, for tryspin negative. Total protein was 2.5 per cent, urea 45 mg/100 c.c.

Fig. 3. After aspiration, the pelvic shadows are shown superimposed. The evidence of calcium deposit along the right border of the mass is clearly revealed.

The sediment showed innumerable pale red blood cells, innumerable leukocytes, no crystals and no parasites. Differential white cell count was 72 per cent polymorphonuclears, 27 per cent small mononuclears, 1 per cent large mononuclears. No bacteria could be demonstrated by smears or cultures. Gelatin sections of the sediment revealed only blood cells and debris. No malignant cells were found.

The patient's abdomen (Fig. 1, *C* and *D*) was relatively flat after the aspiration, even though the mass still extended 10 cm. to the right of the midline at the level of the umbilicus. The tumor felt quite hard, grossly irregular, was slightly movable. Bilateral pyelograms (Fig. 3), March 16, 1931, demonstrated the left pelvis to be 5 cm. nearer the midline and overlying the right pelvis. Extensive calcium deposit in the right half of the tumor was quite evident.

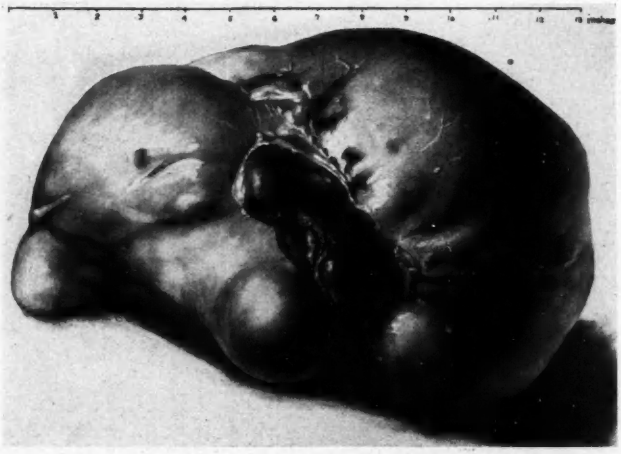

Fig. 4. Note the kidney remnant as an excrescence on the mass. The specimen is drawn to scale, but after considerable shrinkage of fixation.

The patient's general condition began to improve promptly after the establishment of tube drainage. Nausea became very infrequent. The swelling of the left leg receded rapidly though there was some permanent residual enlargement. By the date of nephrectomy hemoglobin had come up to 75 per cent (Sahli), red cell count was 5,400,000.

Operation.—A transperitoneal nephrectomy was done under spinal anesthesia March 20, 1931. Immediately prior to operation, it was demonstrated that there was no fluid dammed up in the cyst cavity. The tumor was freed and removed with surprising ease. It had carried the medial leaf of the mesentery of the colon far to the right and overhung the midline structures in a shelf-like manner. There was no evidence of metastases to the liver or elsewhere in the abdomen. Tube drainage was provided retroperitoneally to the tumor site through

the flank opening previously draining the cyst. Convalescence was uneventful. The patient was discharged April 24, 1931.

Pathological Report.—Gross: A large, irregularly oblong mass (Fig. 4), which measured 40 × 25 × 25 cm. and weighed 5 kilos (11 pounds) as received from the operating room. Under a pressure of 5 feet, barely 2,500 c.c. could be run into the cyst cavity, evidencing

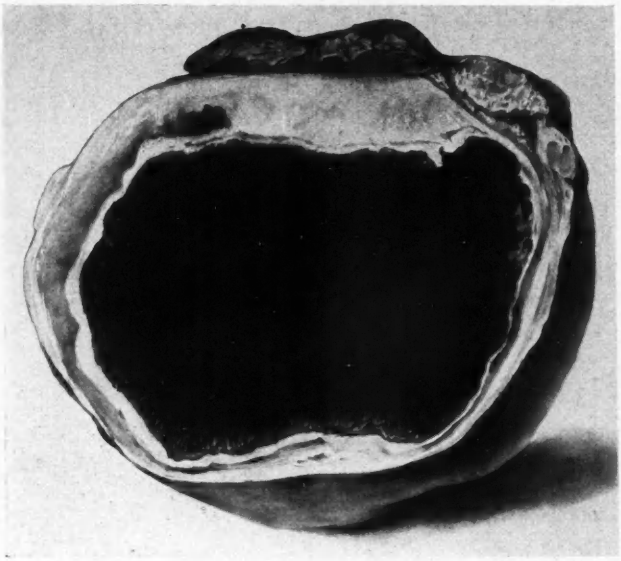

Fig. 5. The specimen on section. Note the varying thickness of the cyst wall and the sharp line of demarcation between kidney and tumor.

the shrinkage that had occurred since aspiration, and the establishment of constant drainage. The kidney appeared as an excrescence, 13 × 7 × 3 cm., on the inner upper aspect of the mass. There were scattered prominences over the mass: some were obviously fatty, others firm and sclerotic; one felt like bone or localized calcium deposit, still another contained a small cyst about 3 cm. in diameter, and was filled with clear jelly-like material. The cyst wall as a whole gave the impression of being quite thick and densely fibrous. On section (after two weeks' fixation and a shrinkage of 7 cm. in the longest diameter) the wall varied in thickness from 0.5 to 4 cm., the thickest portion being immediately adjacent to the kidney (Fig. 5). Demarcation be-

tween the kidney and the cyst wall appeared sharp and abrupt. The kidney remnant grossly showed no evident pathological change. Calcium deposit was obvious at points in the cyst wall. One thick area suggested bone. The cavity of the cyst was lined with shaggy necrotic material, apparently blood and fibrin, having a brownish red color. At least a liter of this material dropped out of the cavity when the cyst was first opened.

Microscopic: Sections through the thinner portion of the cyst wall showed chiefly dense fibrous tissue with an inner necrotic cellular

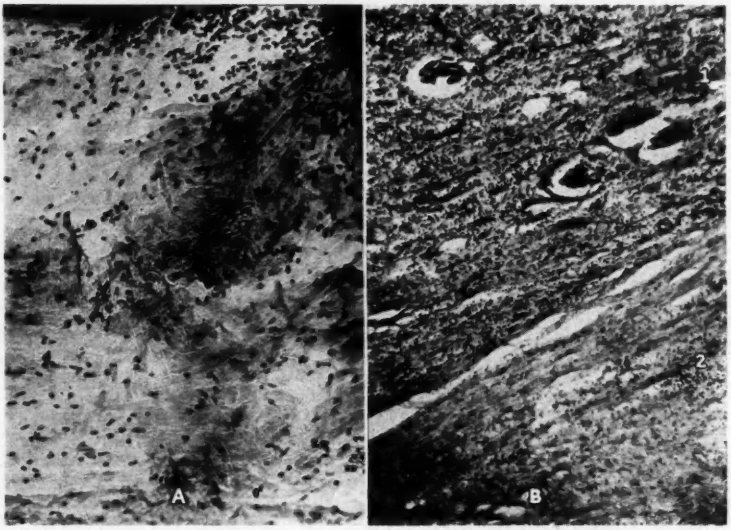

Fig. 6-*A*. An area of myxomatous degeneration with a few large tumor cells and a few calcareous deposits. *B*, juncture between atypical renal tissue (1) and cyst wall (2), the latter densely fibrous at this point.

layer. Blocks from points most remote from the kidney revealed denser fibrous tissue, with some areas of granulation tissue infiltrated with round cells and plasma cells, other areas of myxomatous degeneration (Fig. 6, *A*) and still others of calcium deposit. Large atypical fibroblasts, numerous capillaries and a few tumor-like giant cells were seen in some portions of these sections. Sections from the thickest part of the wall contiguous to the kidney showed in general the same picture that has been described, but, in addition, areas of metaplastic bone formation (Fig. 7, *A*) in the outer portion of the wall where the

tissue was of a more adult type. Central areas of this part of the wall were more cellular and had the appearance of a myxo-fibro-sarcoma (Fig. 7, *B*).

The cyst cavity was lined throughout by necrotic tissue, seemingly quite cellular. Where the architecture had persisted to a slight extent, there was a suggestion of an alveolar arrangement of undifferentiated spheroidal cells, like an alveolar sarcoma. No lining epithelium was made out in any section.

Sections through the small cyst (Fig. 8, *A* and *B*) in the wall of

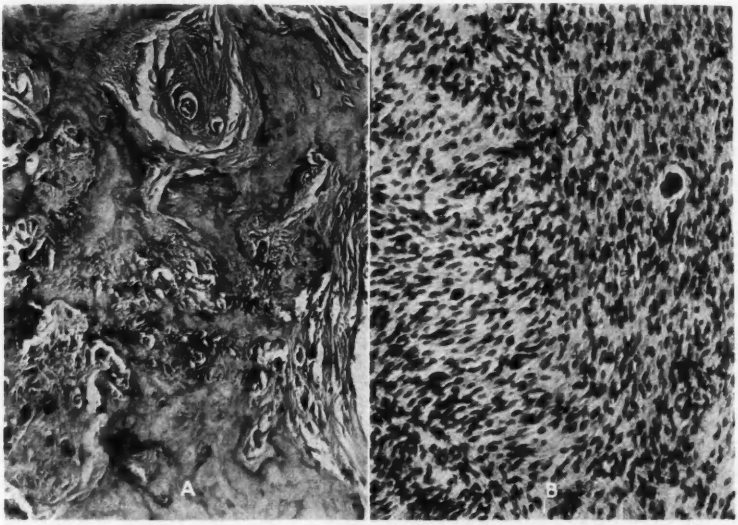

Fig. 7. *A*, atypical cancellous bone metaplasia with calcareous deposits. *B*, area showing large spindle cells and tumor giant cells, suggesting fibrosarcoma.

the larger one revealed a structure similar to that described for the large cyst. But the lining was well preserved and was composed of a thick layer of embryonal undifferentiated cells. These were hyperchromatic and varied greatly in size.

In the sections through the site of junction of the kidney and the cyst wall there was macroscopically a sharp line of demarcation between the two. Microscopically, the kidney tissue continuous with the cyst wall had a very atypical structure, with numerous incomplete tubules and glomeruli, and numerous round and spindle cells, some of which appeared to have formed giant cells (Fig. 6, *B*).

Sections of the kidney from the side opposite the tumor showed a very marked diffuse fibrosis with hyalinization, and a marked atrophy of the tubules. The glomeruli varied in size and many showed hyalinization. The capsule was thickened.

Because of the many tissue types in the cyst wall and the undifferentiated character of the cells bordering the cyst cavity, a diagnosis of a Wilms tumor was made.

Sections were submitted to Dr. James Ewing. He very kindly reviewed them and reported a diagnosis of a Wilms mixed tumor.

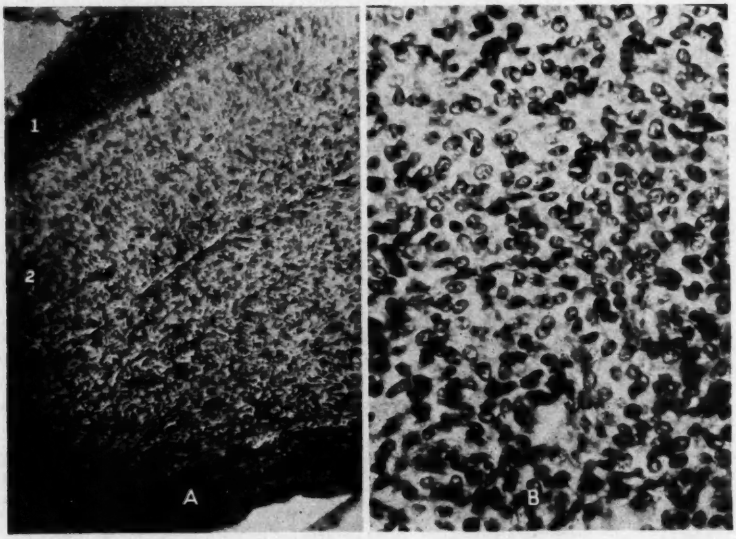

Fig. 8. *A*, section through wall of small cyst in wall of large cyst. (1) Embryonal cells lining cyst cavity. (2) Fibrous tissue with spindle tumor cells and round or polyhedral cells in groups, suggesting an attempt to form tubules. B, embryonal (undifferentiated) cells lining cyst—high power of (1).

COMMENT

I have found records of five solitary cysts larger than that of the case herewith described, and no doubt there are others. Cassioli's specimen contained 12 liters, Lockyer's 25 pints, Lamson's 11 to 12 quarts, Krogius' 10 liters, and Archer's 9 quarts. Cassioli's cyst was marsupialized. Nephrectomy was done for the other four. Archer's

report has added interest because it describes a nephrectomy some fifty years ago when a carbolic spray was an essential feature of operating room technic.

Allowing the weight of an equal volume of water for the 8.5 liters aspirated from my case, I have estimated the admission weight of the specimen at approximately 13.64 kilos (30 pounds).

In the case of Lamson, pyelography demonstrated the right pelvis displaced 10 cm. to the left of the midline. This more nearly approximates the displacement shown in Figure 2 than in any other report I have discovered.

Hepler in 1930 advanced the theory that the large, usually solitary cysts of the kidney are acquired as a result of group tubular blockage and anemic degeneration of the parenchyma, from circulatory changes, in the same segment of the kidney. This mechanism he felt might be initiated by obliterative endarteritis with peritubular sclerosis, by arteriosclerosis, infarct, tumor, and so forth. In other words, widely different pathological processes might lead to cyst formation by bringing this mechanism into play. He put his theory to the experimental test and produced a typical solitary cyst in the rabbit by ligation of the posterior branch of the renal artery and fulguration of the single papilla of this animal's uni-lobed kidney. He so obtained group tubular blockage adjacent to ischemic parenchyma. As far as I can learn, this is the only instance on record of the experimental production of a solitary cyst.

Two of Hepler's personal cases and ten of the 249 he collected from the literature showed islands of tumor cells in the essentially fibrous wall of the cysts. His interpretation was that the tumor had, by chance, caused group tubular blockage and shut off the blood supply of adjacent parenchyma. This naturally could not be proven. In the presence of a tumor nodule in the cyst wall or trapped islands of tumor cells, it seems a fairly reasonable surmise in view of his experimental production of a cyst as above described.

In the first studies of my specimen, I thought the case could be grouped with solitary cysts having what I might call the Hepler type of tumor origin. Further investigation compelled the view that the cyst represented a degenerative change in a tumor because, in many blocks from the inner surface of the cyst, there was a layer of very malignant looking undifferentiated cells. These stained so poorly, however, as to prevent satisfactory interpretation until the

discovery of a small cyst in the major cyst wall. This small cyst seemed a model of the major cyst on microscopical study of its wall. Its lining was composed of a layer of embryonal undifferentiated cells but staining perfectly. There was no hemorrhage in the small cyst, but hemorrhage had no doubt been an important factor in the growth of the major cyst.

A Wilms tumor at the age of fifty-eight is exceedingly rare. The vast majority occur in early infancy. The latest age incidence reported in Ewing's "Neoplastic Diseases" is fifty-four.

I doubt very much whether my patient could have been successfully handled without the preliminary aspiration and continuous drainage. It was only after these procedures that she reversed her downhill trend and slowly gained the strength to permit nephrectomy with any degree of safety. The decreased size of the mass further lessened greatly the required operative dissection and so minimized trauma and shock.

Careful study of the aspirated fluid was made in the hope of learning whether malignancy was present. In view of the later demonstration of a very cellular lining of the cyst, these sections were again gone over after nephrectomy. Even then, they would not allow the diagnosis of malignancy. No doubt the explanation of this failure lay in the extreme degeneration of the cast-off cells. I have found no record of malignancy having been diagnosed from the cytological study of the sediment from the fluid of a renal cyst.

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CALCIFIED CYSTS OF THE KIDNEY

J. A. C. COLSTON, M.D.

From the Brady Urological Institute, Johns Hopkins Hospital, Baltimore, Maryland

Serous cysts of the kidney have long been recognized, their etiology studied, the criteria for diagnosis described and the indications for treatment thoroughly discussed. A few instances of hemorrhagic cysts have been reported, but references to calcified cysts and a clear understanding of their etiology are rare. The *Encyclopedie Francaise d'Urologie* contains no mention of this condition.

In recent years, four interesting examples of calcified cysts of the kidney have been seen at the Brady Institute, and the history and roentgenograms of a fifth case have been furnished through the courtesy of Dr. A. E. Goldstein from his service at the Sinai Hospital, Baltimore. Two of the cases in this series have been described by Young and Waters, who first emphasized trauma as the probable etiological factor.

Abbott, in 1894, described a case of calcified hematoma of the kidney. The patient had been kicked by a horse in the back about fifteen years previously. There is no note as to the occurrence of hematuria. At operation a calcified cyst was found densely adherent to the right kidney. A nephrectomy was done, the patient dying from shock. Apparently this is the first case of calcified cyst of the kidney in which trauma was definitely ascribed as the etiological factor.

Kirwin, in 1926, reported a typical case of calcified cyst attached to the right kidney. The patient had had attacks of burning on urination, with frequency, and blood and pus were present in the urine. There was no history of trauma. Roentgenogram showed a typical large calcified cyst in the kidney region. At operation, the cyst was found so firmly adherent to the kidney that nephrectomy was done. Examination of the specimen showed hydronephrosis with chronic pyelitis and ureteritis. The walls of the cyst were calcified and the contents consisted of yellow fluid. The kidney itself showed no gross lesions. Microscopic examination of the

cyst wall showed it to consist of bundles of connective tissue with areas of necrosis and definite evidences of calcification. The inner wall had no epithelial lining. Kirwin reviews the literature and concludes "that the examination of the specimen fails to reveal whether we are dealing with an old hematoma, an abscess cavity, or a congenital cyst."

Calcified cysts arise from one of two causes—either from hemorrhage into a simple serous cyst or from the natural evolution of a perirenal hematoma, the calcification occurring as a result of the degenerative processes which take place in a hematogenous cyst. As the blood within the cyst wall coagulates, the clots adhere to the wall of the cyst, where they gradually become organized, and calcification occurs from the precipitation of calcium salts in the blood clots. The cyst then remains in a more or less stationary condition and its contents are found to consist of clear yellow fluid with numerous cholesterin crystals. Any disabilities which may be present are due to the size and weight of the cyst and its encroachment upon neighboring viscera.

Microscopic examination of the cyst wall would seem to be the most accurate method to determine the exact etiology. There is a considerable difference of opinion, however, as to the microscopic structure of the wall of simple serous cysts. By some observers, the wall is described as consisting of fibrous tissue without any epithelial lining; others have described various types of epithelial lining, from flattened cells resembling the uriniferous tubules to pavement epithelium, but still others have described an endothelial lining. Most authorities agree that solitary serous cysts result from some obstruction in the uriniferous tubules, probably occurring in embryonic life. If this view be accepted, all congenital cysts should show at least some vestiges of epithelial lining. That hemorrhage into a simple serous cyst may occur is probably true, though it is difficult to understand from the anatomical relationships, since no connection between the kidney tissue and the cyst wall exists although the latter is firmly adherent to the kidney itself. It would seem, therefore, that most hematogenous cysts arise from trauma and in their original stage are not cysts in the true sense but are simple extravasations of blood in the perirenal tissue arising from more or less extensive rupture of the kidney tissue itself.

Stirling has recently reported a case of solitary hemorrhagic

renal cyst which first became apparent a few months after a severe traumatism to the region of the left kidney. A nephrectomy was done, the cyst being removed with the kidney. On microscopic examination the cyst wall was found to consist of fibrous tissue. Stirling reviews the literature and found thirty-one cases reported. He emphasizes the importance of trauma in the etiology of hemorrhagic cysts but was able to find a definite history of injury in only three cases of the series studied. Wesson has reported three instances of injury to the kidney areas in which palpable tumors later appeared in two cases. Herbst and Vynalek reported six solitary cysts of the kidney, of which one was hemorrhagic, the X-rays suggesting calcification with a questionable history of trauma.

The direct relationship of cysts to trauma has been very forcibly presented by the five cases which have been observed in our series. That injuries of the renal parenchyma may give rise to extensive hemorrhage is well known, and the extent of these injuries and their diagnosis and indication for operative interference have been carefully studied. At the thirtieth session of the Association Francaise d'Urologie, a symposium on the diagnosis of the late effects of kidney injuries was held. The various types of rupture of the kidney were fully described, especially by Gerard, who states that a perirenal hematoma may develop, arising from the site of the rupture, which may extend into and encroach upon neighboring structures. Gerard believes that the hematoma usually resolves spontaneously. The late effects of traumatisms to the kidney were fully discussed, but no mention is made of the encapsulation and eventual calcification of these hematomata. Viollet, however, at the same symposium, described the findings in a case of a large blood cyst with a history of severe traumatism thirty-nine years previously, which showed evidence of degeneration, but calcification was apparently not present.

Certainly, in each one of our own series, traumatism was the direct etiological factor, although in only two was hematuria definitely present. It would seem certain that a rupture of the kidney parenchyma which did not extend into the pelvis might lead to a large perirenal hematoma while the intact calices and pelvis would probably not admit the passage of sufficient blood to be noticed in a gross examination of the urine. The bleeding into the perirenal tissues would continue until sufficient pressure was exercised upon

the kidney by the accumulation of blood to stop all hemorrhage. A hematoma, arising in such a manner, will gradually become encapsulated and surrounded by a thick layer of fibrous tissue, and, as the clots adhere to the wall, calcification would occur as has already been described. The hematoma will, of course, vary in size, but may reach enormous proportions, and as resolution progresses its wall may become firmly attached to neighboring viscera, such as intestine, spleen, liver, omentum, et cetera.

PATHOLOGICAL ANATOMY

The cyst wall may be of varying thickness and with variable amounts of calcification present. The contents of the sac are usually found to consist of yellow fluid which may be clear or turbid. On microscopic study the cyst wall is seen to consist of fibrous and scar tissue with irregular areas of calcification and no evidence of a lining, either epithelial or endothelial, will be found. This is a very important point as it enables one definitely to determine whether the cyst has arisen as a result of hemorrhage into a simple serous cyst or as the result of organization of a perirenal hematoma. The relations of the cyst to the kidney are very close and the wall is usually found densely adherent to the true capsule. Here one may also find evidence of the previous rupture, by thickening of the capsule with compression of the renal parenchyma. It is perfectly possible that the kidney might be practically completely destroyed as the result of the trauma so that little but thickened capsule and a few remnants of compressed kidney tissue might be found, but in the three cases we have been able to observe, which were subjected to operation, the kidney was more or less completely preserved and showed only evidence of scarring and atrophy at the site where the cyst wall was adherent. The ureter may be markedly displaced by the pressure of the cyst wall and here again one might expect to find an obstruction with resulting hydroureter and hydronephrosis, but in our series no such obstruction could be demonstrated.

SYMPTOMS

The symptoms result from the pressure and weight of the cyst and are usually not urinary in character. There is often a dull aching pain referred to the kidney region or to the corresponding

costovertebral angle and in no instance has there been any definite story of renal colic. In the case of the larger cysts, the patients have complained of a feeling of weight and heaviness in the corresponding side of the abdomen, and the presence of a palpable mass has been noted by the patient himself. Adhesions to neighboring viscera and impingement upon them by the cyst may cause various kinds of abdominal pain and discomfort and gastro-intestinal manifestations.

DIAGNOSIS

In all our cases, a definite history of severe trauma was obtained, varying from thirty to two and one-half years before the patient came under observation. In three of our cases, a definite mass was palpable which is described as firm, not tender, and rather immovable, with little or no descent on respiration. Physical examination has otherwise not given any information which might lead to the diagnosis. In each instance, the urine was clear, negative chemically and miscroscopically and the culture sterile. The diagnosis was made by examination of the flat X-ray films which showed the outlines of a calcified cyst, varying greatly in size in each instance but in every case showing the typical calcified outline of the periphery of the cyst which in two cases was definitely multilocular, with a varying amount of calcification evident over the extent of the cyst which could be seen within the sharply defined peripheral margin. Satisfactory stereoscopic pyelograms were carried out in three cases which showed normal pelves and ureters but demonstrated very clearly the close apposition of the cyst to the kidney substance. Lateral views in two cases showed this even more clearly. In one case, where the cyst was present in the upper right abdominal cavity, a gall-bladder visualization was done which showed that the cyst bore no close relation to the gall bladder.

The diagnosis is self-evident when good roentgenograms are obtained and if the possibility of the existence of calcified cyst is borne in mind. The only possibility for confusion would be from a hydatid cyst arising from or closely related to the kidney. Craig and Lee Brown have described several cases of this condition and have given a full discussion of the differential diagnosis of calcified shadows in the kidney area. They state that hydatid cyst connected with the kidney should always be diagnosed on account of the

urinary findings, but that a closed hydatid cyst must be diagnosed from the roentgenograms alone. Askin has described a calcified hypernephroma of the kidney and also discussed the differential diagnosis of renal shadows but neither of these authors has taken into consideration the existence of calcified cyst resulting from perirenal hemorrhage. Calcified hypernephroma might lead to temporary confusion but the urinary and functional findings, and especially, the pyelogram, should readily clear up such an unusual condition.

TREATMENT

The ideal treatment for this condition would, of course, be separation of the cyst from the kidney and its complete excision. In our three cases which were subjected to operation, however, such unusual technical difficulties presented that this was not possible. In Case 2, the cyst and kidney were removed but the adhesions to neighboring viscera were so dense that the patient was profoundly shocked and failed to rally from the operation. In one of our cases there were no symptoms and the presence of the cyst was discovered in a routine roentgenogram. This cyst was quite small and was evidently causing no functional difficulties and certainly not increasing in size so that no treatment was advised. In another case, the patient complained of such slight discomfort that again no operation was advised. In the three remaining cases, the symptoms and disability were deemed sufficient to justify operation. The severity of the symptoms depends almost entirely on the size of the cyst, so that only the larger cysts would cause sufficient disability to demand intervention.

On account of the extreme technical difficulties of complete excision which have been emphasized before, this procedure would seem to be contra-indicated, unless in an especial case which we have not observed. In any event, when operation is determined upon, the kidney should be exposed through the usual lumbar incision, the relation of the cyst to the kidney determined, and the cyst should then be explored extra-peritoneally in an effort to find a line of cleavage by which it might be separated from neighboring viscera and removed. In two of our cases treated by this method, no definite line of cleavage could be found and attempts at complete excision were given up on account of the dense adhesions to neighboring structures and the fear of injuring or

interfering with the blood supply of some important viscus. Marsupialization would seem to be the method of choice in dealing with these large cysts which cannot be excised. The value of this procedure has already been described and emphasized by Craig and Lee Brown in the treatment of hydatid cysts which present identical technical difficulties from an operative standpoint. The cyst wall is opened, and as much of it is excised as possible without interfering with neighboring viscera or opening the peritoneal cavity. The cyst is thus emptied of its fluid contents and the walls should then be pressed together in apposition with ample facilities for free drainage. In our one case treated by this method, a persistent sinus has remained in the kidney region, which, however, discharges only small amounts of thin serous fluid with occasional particles of calcified tissue, and the wound has required only simple dressings. There has been no tendency for the cyst to re-form. The abdominal mass has disappeared and the patient has been greatly relieved of symptoms although he still complains of some dull pain in the flank radiating to the groin.

Case 1.—S. R. T., aged forty-eight, mail carrier, was admitted to the hospital March 1, 1924, for treatment of enlarged testicle. Family history was unimportant. The patient had never had any serious illness. He had lived in North Carolina all his life, working outdoors chiefly as a mail carrier. He denied any venereal infection. About ten years ago the right testicle enlarged and was removed by a local surgeon. He did not know what diagnosis was made.

On further questioning, the patient stated that thirty years ago he was run over by a wagon, the wheels passing over his left side. He remained in bed several days, noticed no blood in his urine, and his convalescence was uneventful. Six months later the abdomen swelled markedly and was punctured with a needle on two occasions, a total of three gallons of clear fluid being removed. Following this procedure the patient had no further trouble.

On physical examination the following diagnosis was made:

1. Tuberculous epididymitis, left.
2. Tuberculosis of vas deferens, bilateral (the right testicle had been removed).
3. Tuberculous seminal vesiculitis, bilateral.
4. Pulmonary tuberculosis, inactive—old fibrosis of left apex.
5. Marked dental caries and pyorrhea alveolaris.
6. Slight secondary anemia.

The urine was clear, chemically negative and microscopically contained only a few pus cells. No tubercle bacilli or other organisms could be demonstrated.

The plain roentgenogram (Fig. 1) showed a large calcified shadow in the left upper quadrant, measuring about 10 × 7 cm. The outlines of the shadow were slightly irregular but very clearly defined and the density seemed more pronounced at the periphery of the shadow, which suggested that the structure was a calcified cyst.

On March 5, 1924, Dr. Young carried out his operation of radical excision of the seminal tract for tuberculosis under spinal anesthesia. The patient made an uneventful convalescence and left the hospital on April 15 with a small perineal urinary fistula. The patient was next

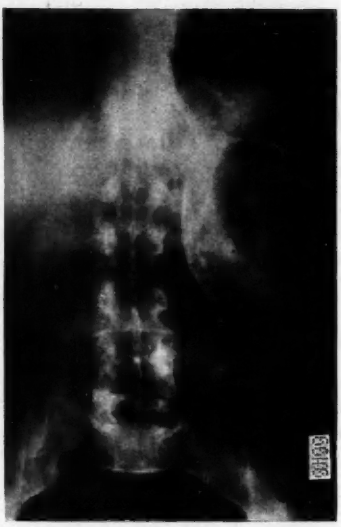

Fig. 1. Case 1. Antero-posterior view of large calcified cyst in the left upper quadrant.

seen in January, 1925, at which time he was in excellent condition, and the result of the operation very satisfactory with the exception that the small perineal fistula still persisted and discharged a few drops at each urination. On rectal examination scar tissue, which was fairly soft and pliable, could be felt in the region of the prostate, the seminal vesicles and the base of the bladder. There had been apparently no change in the pulmonary condition. On account of the absence of symptoms the patient was discharged without treatment.

He returned again on April 6, 1926, complaining of dull pain in the region of the left kidney, worse during the morning. His general

condition was excellent and the small perineal fistula which leaked a few drops only on urination was causing him no trouble. There had taken place, however, a considerable atrophy of the only remaining left testis. On cystoscopic examination the internal orifice, trigone, ureteral orifices and bladder mucosa were essentially normal. Catheters ascended to each kidney without meeting any obstruction. The specimen from the right kidney contained a few pus cells and its function as measured by the urea percentage was distinctly lower than that of the left, which contained no pus cells. No tubercle bacilli were found

Fig. 2. Case 1. Stereoscopic left pyelogram. The pelvis is well filled. Calices are cup-shaped and normal. There is no dilatation or other abnormality of the pelvis. In the stereoscope the cyst can be seen lying in front of and in close approximation to the kidney.

Fig. 3. Case 1. Lateral view of pyelogram showing the close approximation of the cyst to the anterior surface of the kidney.

from either side and cultures were sterile. A stereoscopic pyleogram was done on the left side which showed a normal ureter and pelvis. The whole cyst could be clearly seen lying in front of the kidney but apparently quite close to it (Fig. 2). A lateral view (Fig. 3) shows the close relationship of the cyst to this anterior surface of the kidney.

On April 9, Dr. Young exposed the kidney by the usual extraperitoneal incision. Adhesions about the kidney were very marked

and a distinct white depressed scar was found on the anterior surface. More adhesions with a depressed white scar were found at a distance of 1 cm. from the first scar. No definite connection could be demonstrated between these scars and the cyst, which could be felt lying in close apposition to the anterior surface of the kidney. The pelvis and ureter and the vascular pedicle were normal. Attempts to expose the cyst by dissection through the perirenal fat towards the peritoneum led to bleeding from large veins which were present, and the operator feared to proceed further in this direction on account of the danger

Fig. 4. Case 2. Showing a large multilocular calcified cyst occupying the entire right side of the abdominal cavity.

of injury to the blood supply of the descending colon, which could be felt behind the peritoneum on the external aspect of the cyst. The peritoneum was then purposely opened and the mass was found to be everywhere closely adherent to omentum. The whole extent of the cyst, however, could be easily palpated and it was found to be extremely hard, irregular, with sharp edges and in places depressions were present. It was slightly movable but was fixed to the posterior peritoneum in the region of the descending colon. No demonstrable obstruction to the intestine could be made out and on account of the numerous adhesions to the omentum and the fear of interfering with

the intestinal blood supply, no further attempt was made to remove it. The incision was closed in the usual manner and the patient made an uninterrupted recovery, leaving the hospital in fifteen days.

Case 2.—H. B. was admitted to Sinai Hospital on the service of Dr. Goldstein, February 2, 1926, complaining of a large mass in the right side of the abdomen and inability to walk properly.

The family and past histories were unimportant.

Twenty-five years ago the patient was kicked by a horse in the right flank, was prostrated, but could not remember whether or not blood was present in the urine. Following this, a mass appeared in the right flank which became slowly progressive in size but caused no distress until about six months ago, when it began to interfere with locomotion. The patient had had no urinary symptoms.

Physical examination showed nothing of importance except in the abdomen, where a solid, irregular mass could be felt, extending across the midline, 5 cm. below the crest of the ilium and upward underneath the costal margin. This mass was fixed, firm and did not descend on inspiration. The urine was clear, negative chemically and microscopically. The phthalein excretion was 55 per cent in two hours. Cystoscopic examination showed the prostatic orifice normal. The right ureter could easily be seen; a catheter engaged in the orifice but did not pass any further. The urine from the left kidney was normal microscopically. A plain X-ray (Fig. 4) showed three huge, apparently intercommunicating cysts, with irregular areas of calcification in the walls, with a deep septum between the larger cysts; no kidney structure was visible.

At operation the kidney with the tremendous cyst closely adherent to its posterior border was exposed and after great technical difficulties the cyst was separated from dense adhesions to intraperitoneal viscera and removed with the kidney. The patient was severely shocked and failed to rally, death occurring twenty-four hours after operation.

Case 3.—G. K., aged thirty-eight, lunch room manager, was admitted October 18, 1923, complaining of pain in the back. Family history was unimportant. The general health has always been good and the patient has never had any serious illnesses. He lived for fifteen years in Greece, then came to America, since when he has lived in Pennsylvania. He denied venereal disease or any other infection of the genito-urinary tract.

The present illness began as a result of a serious automobile accident in 1919, four years previously. He suffered a fracture of the frontal bone and was injured about the back. On being taken to the hospital he passed bloody urine but did not remember about the duration of this symptom. He developed pneumonia on the third day and remained in the hospital for six weeks. About eight months ago he began to have a dull, more or less constant pain in the region of the

right kidney which had gradually become worse. He had had no attacks of acute pain and no urinary symptoms.

On physical examination, no abnormalities could be made out other than a roughened area in the region of the left supra-orbital ridge, probably a result of the old fracture. On palpation of the abdomen, an indefinite mass could be felt in the region of the right kidney which descended on inspiration. This mass extended about 3 cm. below the costal margin and was not tender. It was thought to be an enlarged right kidney.

Fig. 5. Case 3. Well defined, moderate sized calcified cyst lying in the region of the right kidney.

Fig. 6. Case 3. Stereoscopic right pyelogram. Pelvis is well filled, the calices are normal, there is no dilatation or other abnormality of the pelvis. In the stereoscopic view, the cyst is seen to lie in close approximation to the anterior surface and convex border of the kidney.

The urine was clear and normal chemically and microscopically and the culture was sterile.

On cystoscopic examination, the internal orifice, the bladder mucosa, trigone and ureters were normal. Ureteral catheters ascended to each kidney without meeting any obstruction and the specimens from each kidney were normal, of good and equal function, and the cultures were sterile. The plain roentgenogram (Fig. 5) showed a large calcified cyst-like structure in the region of the right kidney. Fluoroscopy showed that the mass lay outside of the stomach and colon. The patient was discharged and no treatment advised.

He returned in April, 1926, for further study and stated that during the interval since his last visit the pain had decreased considerably but that he was still subject to some dull intermittent aching pains in the right kidney region.

On physical examination, the findings were identical with those of three years before. The urine was clear and the culture sterile. Plain roentgenogram showed that there had been no change in the size of the cyst. Gall-bladder visualization done by the administration of tetraiodophenolphthalein showed a normal gall bladder with normal emptying time. A stereoscopic pyelogram showed a normal pelvis and

Fig. 7. Case 4. A large calcified cyst with irregular margins occupying the entire left side of the abdomen. Only at the upper left border can the cyst margin be definitely made out. The calcification in this case is not so pronounced as in the preceding instances. The huge size of the cyst has caused marked scoliosis.

Fig. 8. Case 4. Lateral view, eight months postoperative. The tube in the sinus has been injected with sodium iodide. No areas of calcification can be seen, the cyst walls probably having collapsed and their outlines being obscured by the vertebral shadows.

ureter with the cyst lying in close apposition to the anterior surface of the kidney (Fig. 6). A diagnosis of calcified traumatic cyst, attached to the kidney, was made, and in view of the experiences gained from the two previous cases and the relatively few symptoms present, no operative interference was advised.

Case 4.—S. M. S., aged thirty-one, was admitted March 14, 1929, complaining of hardness over the left side of the abdomen and numbness in the left leg. The family history was unimportant. The patient was struck by a sled, receiving a severe injury to the left side and kidney region, at the age of ten years. He was unconscious for a few hours, was confined to bed for some time but did not remember whether there was blood in the urine. Kidney drainage by puncture was done, two and a half years ago, a large amount of reddish fluid being withdrawn. Following this the mass collapsed but became as large as ever in about two weeks' time. Complete examination at another clinic was carried out which showed the left kidney functionless. A diagnosis of huge left hydronephrosis with possible calcification and occlusion at the ureteropelvic junction was made. Removal of the left kidney was advised.

Physical examination revealed nothing of importance except in the abdomen. The left side of the abdomen was slightly more prominent than the right, particularly in the lower two-thirds. A large, firm mass was felt filling the left flank, extending almost from the pelvis to the left costal margin. The mass was smooth, not tender, did not move with respiration, and was everywhere dull to percussion. Neither kidney could be felt but the liver was just palpable at the costal margin, smooth, regular, not tender. The prostate was normal and the urine negative chemically and microscopically. Cultures were sterile. A stereoscopic plain roentgenogram (Fig. 7) showed a huge mass on the left side, partially calcified, the edges clearly outlined, slightly irregular, while the walls of the cyst showed irregular areas of calcification. This cyst extended from a point 5 cm. below the crest of the ilium upwards as far as the tenth rib, the vesical border being obscured by the vertebral shadow.

Cystoscopic examination showed no intravesical enlargement of the prostate. The trigone and ureteral orifices were normal. A catheter entered the left ureter for a distance of about 2 or 3 inches where an impassable obstruction was met. Sodium iodide was injected in an attempt to make a left pyelogram, but on examination of the film only a faint trace was seen in the kidney region, the majority of the fluid having run back into the bladder. No urine was obtained from the left kidney.

On March 20, under gas anesthesia, the cyst was exposed extraperitoneally in the usual manner, care being taken not to injure the peritoneum. After the muscles were divided and the deep fascia opened, a large thick-walled cyst which was very tense and had dense adhesions to surrounding structures was encountered. The kidney could not be identified nor were there any evidences of the pelvis or of the ureter. It was impossible to find any definite line of cleavage, and in attempting to free the cyst from adhesions the wall was ruptured and about four liters of turbid fluid evacuated. Further dissec-

tion was attempted but the peritoneum and bowel were so densely adherent to the cyst wall that the operator considered it unwise to attempt complete dissection. The peritoneum was opened in two places, being closed immediately with plain catgut. The part of the cyst which had been freed was then cut away and the rest collapsed as far as possible and the cavity drained with two large rubber tubes. The wound was closed in the usual way with silver wire stay sutures. The patient's postoperative convalescence was stormy and an elevation of temperature persisted for five days. The wound drained profusely

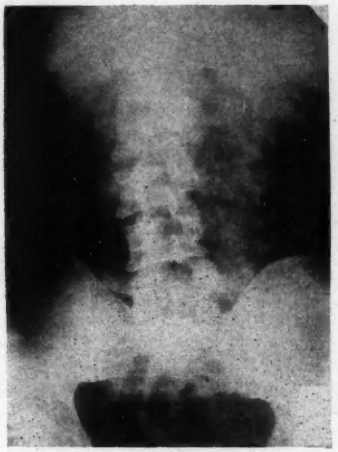

Fig. 9. Case 4. Antero-posterior view, twenty months postoperative. Outlines of the cyst cannot be made out. There are some indefinite areas of calcification in the left side of the abdominal cavity. There has evidently been marked diminution in the size of the cyst and marked improvement in the scoliosis.

Fig. 10. Case 4. Postero-anterior view, twenty months postoperative. Outlines of the cyst can no longer be made out. Indefinite calcification is seen in the left side of the abdomen with marked accentuation of calcification in linear areas as if there had been approximation of the walls of the cyst with intensification of the shadow.

and the patient was discharged on April 27, with a small rubber tube still present in the drainage tract.

Pathological examination of the portion of cyst excised showed it to consist of a portion of the wall of the sac consisting of thickened scar tissue with irregular areas of calcification. On microscopic examination the wall was found to be made up of fibrous tissue with areas

of calcification and dense scar tissue. No definite epithelial lining could be found nor could any kidney tissue be identified.

The patient was seen again November, 1930. He has been quite well although some pain is present in the left loin, radiating to the groin. There were no urinary symptoms. Abdominal palpation revealed that the large mass previously present had entirely disappeared and there was present only an indefinite sense of resistance in the upper left quadrant of the abdomen. The sinus has drained small amounts, occasionally small pieces of hard substance. The incision is well-healed except for a small sinus tract at the upper angle from which there is a slight amount of seropurulent drainage. A plain roentgenogram (Fig. 8) with injection of sodium iodide in the sinus tract shows the large rubber drainage tube in place, a small amount of sodium iodide in one of the cavities. There is a marked grade of scoliosis, probably produced by the mass. Anteroposterior view (Fig. 9) shows very marked diminution on the size of the mass, which is no longer clearly outlined, and there has been very definite improvement in the scoliosis. The outlines of the cyst no longer are clearly seen and in the left lumbar region one sees at present only some irregular areas of calcification which have no definite form. In the postero-anterior view (Fig. 10), November 20, 1930 (twenty months postoperative), the outlines of the cyst are no longer clearly defined. There has been definite diminution in the volume of the cyst and the calcification is more pronounced as if, at certain points, the cyst walls had collapsed and were in apposition. There has been evidently a very marked diminution in the size of the mass.

Case 5.—J. S., aged sixty-three, laborer, was admitted October 16, 1930, complaining of frequent urination.

The family history was unimportant.

Two years ago the patient contracted an acute specific urethritis which cleared up in nine weeks under local treatment. About a year and a half ago he fell a distance of about 8 feet as a result of a broken scaffold and was struck apparently in the middle of the back by several heavy planks. He was unconscious and unable to walk for a short time and was incapacitated from work for four weeks. At no time was there any blood in the urine. There has been no pain, stiffness or discomfort in the back since the accident. Frequency of urination had persisted since the urethral infection, but there was no obstruction or pain.

Physical examination revealed an extensive emphysema and a moderate generalized arteriosclerosis. The urine was normal chemically and microscopically and the culture was sterile. The prostate was moderately enlarged, firm, but no nodules were felt. The secretion showed a considerable increase of pus cells. Cystoscopic examination showed slight intravesical hypertrophy of the lateral lobes and definite median bar formation. On October 17, a cautery punch operation was

done by Dr. Young, five cuts being removed. The postoperative course was uneventful except for transient elevation of temperature two days after operation, during which a few colonies of hemolytic staphylococci were obtained on culture. The temperature quickly fell to normal and the blood culture became sterile. The patient left the hospital October 30 in excellent condition.

The patient returned February, 1931, complaining of burning on urination together with pain when the bladder is full. He voided urine freely without difficulty, gets up twice at night, holds urine four

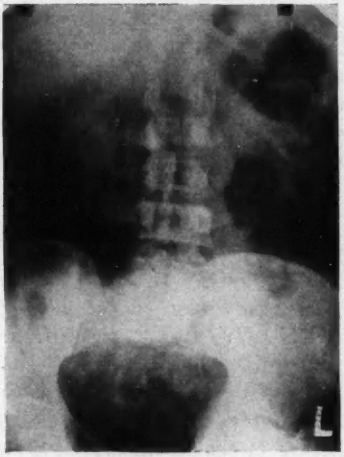

Fig. 11. Case 5. A small calcified cyst with well defined margins is seen lying in proximity to the upper pole and convex border of the right kidney.

hours during the day. During the past four months a burning sensation in the hips sometimes extending from leg to sole of foot has become manifest. A plain X-ray (Fig. 11) showed the outlines of the kidneys to be of normal size and in normal position. There is a well defined shadow measuring about 5 × 6 cm. in the right upper quadrant opposite the upper pole of the kidney but apparently in close contact with the kidney. The outlines of this shadow are slightly irregular, but quite plain and intensified. Within the well defined outline faint irregular shadows are seen suggesting irregular areas of calcification in a cyst wall. There was a moderate grade of arthritis of the lumbar spine which was considered to be responsible for the sensations of which the patient complained in the hips, legs and heels. On account

of the fact that there were no symptoms definitely referable to the cyst and the experiences in the study of the similar cases previously seen, no operation was advised and the patient was put upon a regime to control the arthritis. It was considered that the calcified cyst represented the late stage of a hematoma which had arisen as a result of the trauma, the source of the original hemorrhage probably being a small rupture in the kidney.

One of the most interesting questions which arises in the consideration of these calcified cysts is their prevention as it has been shown by this series that they may cause serious disability. In those cases which might arise from bleeding into a pre-existent serous cyst, the prophylaxis lies, of course, in the early diagnosis of the cyst and its excision. In any event, the size of the calcified cyst in such a case would depend upon the size of the pre-existent serous cyst, so if the resulting calcified cyst were sufficiently large to cause disability it would seem certain that the presence of the serous cyst would have been manifested by some symptoms before the bleeding into it had occurred.

The question of the prevention of the development of calcified cysts which arise as a result of trauma lies, of course, in the correct treatment of the traumatized kidney. Injury of the kidney from trauma either from exterior contusion, such as may arise from blows and automobile accidents, or from penetrating missiles, such as gunshot wounds, are almost invariably associated with injuries to other organs, so that the diagnosis and treatment of the kidney damage may be overshadowed by the other injuries which the patient may have received and also by his general condition. The determination of the actual amount of kidney damage which has been done is often extremely difficult. The history of the injury together with the course of the traumatic agent in penetrating wounds is, of course, of the utmost importance. The presence of hematuria is conclusive evidence of kidney damage, but by this symptom alone one cannot determine the extent of the damage, as severe injuries may be accompanied by small amounts of blood in the urine, while conversely a slight injury may lead to persistent hemorrhage. The well known signs of internal bleeding may be present but are often difficult to differentiate from shock. Tenderness and muscle spasm in the kidney region and in the costovertebral angle are usually present in any injury of a considerable de-

gree, but here again the differentiation between kidney injury and damage to some intraperitoneal viscus or an early peritonitis presents problems of particular difficulty. The presence of a mass in the kidney region is the most important sign of severe damage. If the tumor can be demonstrated to be slowly increasing in size there may be little doubt about the presence of a hematoma, especially if signs of internal hemorrhage are present.

It is, of course, a well known fact that many injuries of the kidney, some of considerable degree, may heal spontaneously and that the hematoma surrounding the kidney may be absorbed without leaving any persistent after-effects. It is, of course, impossible to lay down any definite rules as to the management of these cases, every one of which presents individual problems. However, the control of an acute hemorrhage, of course, lies in the immediate exposure with either suture of the injuries or nephrectomy, as the case may seem to require. Some cases which recover from the symptoms of acute shock in which the internal bleeding has evidently stopped may show a persistent mass in the kidney region which represents a more or less extensive hematoma. When a case has presented features leading to the suspicion of kidney damage with a persistent mass and signs of hemorrhage and shock, operative intervention would seem to be definitely indicated, provided the patient's general condition and concomitant injuries may permit. It is from this type of large perirenal hematoma that the majority of calcified cysts arise.

The kidney should be thoroughly exposed, the hematoma completely evacuated of its clots, any injuries to the kidney parenchyma repaired and free drainage provided. The conservative management of many kidney injuries is undoubtedly justified, but when one may suspect from the roentgenogram by a large cloudy area in the kidney region that a perirenal hematoma of any extent is present, the evacuation of this hematoma is urgently indicated to prevent the future development of a calcified cyst which may result in marked disability and may jeopardize the life of the patient.

CONCLUSIONS

1. A series of five calcified cysts, all proven to be intimately connected with the kidney, is presented and their traumatic origin has been demonstrated without question of doubt.

2. Calcified cysts of the kidney arise from the precipitation in the wall of the cyst of calcium salts from the blood clots with which the cyst is filled.

3. The differentiation between calcified cysts of traumatic origin and those arising from hemorrhage into a pre-existent serous cyst can be definitely determined by the character of the lining of the cyst.

4. In calcified cysts the wall is found to consist of fibrous tissue, with irregular areas of calcification without epithelial lining, while in the case of hematogenous cysts which arise as a result of hemorrhage into a simple serous cyst a definite flattened cuboidal epithelial lining has been usually described.

5. The diagnosis of calcified cyst is rendered certain by the plain roentgenogram.

6. On account of the technical difficulties due to adherence of the cyst to neighboring viscera, no attempt at complete excision should be made unless the symptoms are definite and pronounced.

7. When the patient's symptoms are of sufficient degree to command intervention, operation should consist in exposure of the kidney and the adherent cyst, and if, as is usually the case, it becomes evident that complete excision is impossible, the operation should be limited to excision of as much of the cyst as can be safely removed, marsupialization of the remaining portion of the cyst, and institution of free drainage.

8. The prophylaxis of calcified cysts lies in the early recognition and evacuation of any extensive perirenal hematoma.

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DISCUSSION

DR. NATHANIEL G. ALCOCK: These two cases are of intense interest to me because we have had some that simulate it and both fit in with the problem upon which we have been working.

(Slide) This is a large calcified cyst and it is not connected at all with the kidney. You see it is very similar to the one that was just shown. The function of this kidney was always one-sixth of the other and the stereopyelogram shows that this ureter runs along that cyst wall and that the cyst is retroperitoneal. I attempted to take it out; the patient died on the able and we got an autopsy. In that case it was not connected with any of the organs; it was separate from the kidney and separate from the pancreas, but was associated with all of them. It proved to be an epithelial cyst.

(Slide) Here is another, of which we have had three of the very same kind, a very large calcified tumor.

(Slide) You will notice this is also on the left side and the kidney is closely associated but not connected with the cyst. It is retroperitoneal. We have one smaller than that higher up; another one smaller than that lower down.

Our pathologist became interested in these unattached retroperitoneal tumors and in collecting and reporting eighteen of them he finds the interesting fact that in these tumors there is a duplication of almost every tumor to be found in the urogenital tract, tumors that simulate those in the ovary and in the uterus.

This one (pointing) was an adrenal cell carcinoma. We have had two of these. Our pathologist's theory is that they develop from the urogenital ridge and are not attached to any of the organs. I think it is a very interesting field.

DR. J. A. C. COLSTON (Baltimore): In our cases our cysts have arisen from rupture in the kidney. I feel that injuries of the kidney should not be regarded lightly; that if there is definite evidence to justify one in believing that a fairly extensive rupture has occurred, the kidney should be exposed and the hematoma surrounding it evacuated and sufficient drainage instituted. Of course, a large proportion of ruptures of the kidney will heal

spontaneously, but if we are to prevent the formation of these very large cysts with their consequent disability, if any sufficient hemorrhage arises in the region of the kidney it should be evacuated and drained.

BACTERIAL CONCRETIONS IN THE KIDNEY PELVIS

WITH REPORT OF TWO PERSONAL CASES

A. J. SCHOLL, M.D., F.A.C.S.
Los Angeles, California

Occasionally there are met in the literature reports in which so-called bacterial or fibrin concrements are described as found in the kidney pelvis either at autopsy or operation. Such masses are soft and friable and consist of a nucleus or layers of fibrin with perhaps a few crystals among them. Gage and Beal[3] collected a series of soft fibrinous kidney concrements in 1908 and the literature contains some isolated reports since then.

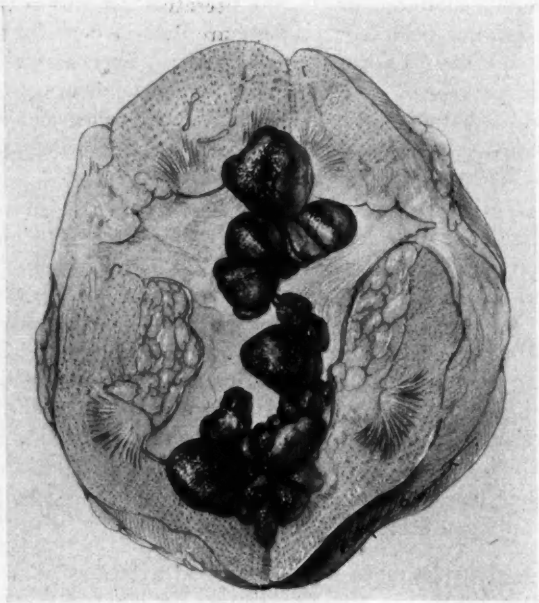
Apart from these fibrinous calculi, however, I wish to report here on another much rarer type of soft kidney stones, namely concrements composed entirely of bacteria. Only a very small number of cases of this type have been reported and these I will refer to later on. In Israel's book, "Chirurgie der Niere und des Harnleiters" (1925, p. 234), four such cases are mentioned. The concretions are described as "soft, elastic bodies varying in size from that of a bean to a cherry, occurring in the pelvis of the kidney; round, oval or tetrahedraform in shape, and composed entirely of coli bacteria."

I have had two personal cases of this latter nature, the histories of which are as follows:

Case 1.—A woman, aged thirty-four, had a feeling of discomfort in the right loin for twelve years. During the last five years she had definite attacks of pain in the right kidney region that were occasionally associated with chills and fever. The pains were usually of short duration, of moderate intensity and were frequently followed by the passage of one or more stones. Altogether she had passed about thirty stones, most of which were about the size of a bean. They were soft and elastic and could easily be crushed between the fingers. Four years ago she had a right nephrotomy, at which time a single large stone was removed (details as to the size and consistency of this stone were not available). She had a very stormy convalescence following her operation, which did not interrupt the passage of stones, as she passed several three days after operation and has continued to do

so every few months up to the present time. During the last five years her urine has been cloudy and contained pus, but she has had very little bladder pain or frequency of urination. For the last six months she had lost about 15 pounds, had almost constant pain and was able to do but very little work.

Physical examination revealed an emaciated woman, weighing 105 pounds. The right kidney, which could be palpated, was somewhat tender. There was a short, puckered scar in the right costo-vertebral area.



1. Multiple soft stones matted together in pelvis.

The urine contained a large amount of pus and blood. The two-hour intravenously injected phthalein return was 50 per cent. A roentgenogram of the kidneys and bladder revealed numerous indefinite shadows in the region of the right kidney. The shadows varied in size from 0.5 to 2 cm.; they were confined in a small, definite area, similar to the localized clumping of gallstones. Several of the shadows were lamellated but they were without the outside dense ring so commonly seen in gallstones. An X-ray of the biliary tract after

the ingestion of gall-bladder dyes revealed a normal appearing gall bladder separate from the shadows previously noted.

Cystoscopy revealed an almost completely functionless right kidney. The function of the opposite kidney was nomal. A right pyelogram showed an enlarged, distorted pelvis containing numerous areas of lesser density corresponding to the shadows seen in the original X-ray picture.

A right posterior lateral incision was made below and posterior to the previous incision. The kidney was readily delivered but the con-

2. Tetrahedraform shaped stones showing lamellation.

vex border was markedly adherent to the pleura. It was necessary to use sharp dissection to free these adhesions; the capsule in one area was stripped from the kidney and a portion left adherent to the pleura.

The kidney was soft, pyonephrotic, and contained only a small amount of functioning tissue. The pelvis was dilated and thickened and contained what seemed to be a soft elastic mass. No definite stones could be felt. The renal vessels and the ureter, which was thickened and dilated, were clamped and cut and the kidney removed.

The patient recovered readily from the operation and had a normal convalescence.

Pathologic Report.—The removed kidney was normal in size and somewhat lobulated. The capsule was densely adherent in several places on the convexity of the kidney. On opening the kidney, the pelvis was considerably dilated, and the mucous membrane thickened. There were several scars in which the cortical substance was destroyed. The pelvis was almost completely filled with soft, friable greyish-yellow stones; there were about twelve of these stones measuring from 0.5 to 2 cm. in diameter (Fig. 1). Most of the stones had

flattened surfaces due to pressure. The outer surfaces of the stones were smooth and rubbery and the flattened surfaces almost resembled the faceted surfaces so commonly occurring with gall stones (Fig. 2). The stones could readily be crushed with forceps or flattened between the fingers. Examination of the soft elastic material composing these stones by placing a portion in a drop of water and observing microscopically showed large numbers of bacteria (B. coli) with a few red blood cells and leukocytes. Culture of the same material showed a growth of B. coli with occasional colonies of streptococci. The entire stones were composed of bacteria. Examinations or cultures from either the surface or the center of cut or crushed stones revealed the same condition.

The kidney parenchyma was moderately fibrous. Sections showed large scars in the cortex in which there were many fibrotic glomeruli, atrophy of the tubules, heavy round cell infiltration and more or less hemorrhage. Between the scars the glomeruli were congested and the tubular epithelium showed a marked granular swelling. The pelvic mucosa was thickened and heavily infiltrated with round cells.

COMMENT

The important point in this case to which attention is invited is the nature of the pelvic concretions. The density of the stones was less than that of the pyelographic material. This is rather an unusual occurrence and indicated that only a small amount of shadow-casting material was present. Usually traces of calcium, sodium, and phosphate are found.

A nephrectomy was done as it was impossible to remove all the soft, putty-like material, and this kidney was functionless and not essential. The opposite kidney was entirely sufficient to support life. The patient lived in an inaccessible district where it was difficult to obtain medical care. If the kidney had not been removed and a more conservative procedure attempted, it might later have been necessary to resort again to surgery.

Case 2.—A woman, aged sixty-one, had an occasional attack of pain in the right loin during the last five months. The pain usually lasted from one to two days. Her last attack began five days ago. It was of moderate intensity, fairly persistent and associated with a generalized jaundice. She was slightly nauseated and had moderate frequency of urination. Previous to the last five months she always considered herself well except that, for the last twenty years, she has had twinges of pain and a sense of discomfort under the right costal margin. She had a good appetite, could eat any food without distress, and did all of her house work.

Examination revealed a thin, small woman with a definite generalized jaundice. The right kidney was tender, easily palpated and freely movable. The liver edge could be readily felt below the costal margin and was somewhat tender.

The urine contained a large amount of pus, some bile, a few red blood cells and a trace of albumin. The two-hour intravenous phthalein return was 47 per cent. X-ray examination of her kidneys and bladder revealed a somewhat indistinct shadow 2 × 3 cm. in the region of the right kidney.

Cystoscopy showed the urine from the left kidney was clear but that from the right was cloudy and contained pus and blood. The fifteen-minute phthalein return was 2 per cent on the right side and 14 per cent on the left side. A right pyelogram included the shadow seen in the original X-ray picture. As the patient was recovering from her pain, she was kept waiting for two months before any surgical procedure was attempted, during which time her jaundice cleared up completely, she gained weight and felt in much better health.

The kidney was delivered through a right postero-lateral incision. It was about 5 cm. below the normal location and moderately adherent to the overlying fat and to the peritoneum, though quite freely movable. The liver extended down about 3 cm. below the costal border. When the peritoneum was stripped, there was considerable stippling of the renal surface. The cortex was hard and firmer than normal kidney tissue, suggesting an extensive fibrosis. The kidney was about normal in size but contained very little normal appearing or normal feeling tissue. The kidney pelvis was slightly dilated, thickened, and the ureter was 1 cm. in diameter, with thickened, stiffened walls. The pelvis was opened and a large amount of soft, putty-like stone material extruded. There was also a large amount of mucous and necrotic tissue expelled through the opening. The vascular pedicle and ureter were clamped, cut and tied separately and the kidney removed.

Pathologic Report.—The specimen consisted of a small kidney measuring 9.5 × 4.5 × 3 cm. The pelvis was moderately enlarged and contained five soft, light brown stones. These were very soft so that they could be crushed between the fingers. Examination of the material composing these stones, by placing some in a drop of water and examining microscopically, showed large numbers of bacteria (B. coli). Cultures taken from the surface of the stones or from the central portions of crushed stones revealed a growth of B. coli. The mucous membrane of the pelvis was distinctly thickened and congested. The renal parenchyma was pale, firm and rubbery and apparently markedly fibrotic.

Sections showed a very diffuse, fibrous, extensive atrophy of the tubules; many glomeruli were surrounded by fibrous tissue. There was an extremely heavy round cell infiltration throughout. At one

place in the pelvis was a circumscribed fibrous area that appeared to be an organized thrombosis. In places the tubules were hypertrophied.

COMMENT

In this, as in the previous case, it was possible to obtain active colon bacilli or a positive culture from any part of the stones either on the surface or from the cut section. In both cases the kidneys were partially or almost completely destroyed and in such a condition that it would be impossible to obtain a permanent cure by attempting to remove the stone fragments.

Due to the lack of normal kidney tissue or function on this side, the displacement of the kidney, the extensive fibrosis, the patient's age, and because of the normal function of the opposite kidney, a nephrectomy was done.

The definite jaundice that was seen two months before operation was probably due to the downward pull of the heavy fibrotic kidney on the biliary passages. It has been shown that a right movable kidney drawn forward and downward causes traction on the duodenum at a point 2 or 3 cm. below the entrance of the biliary tract; and, though it does not occlude the lumen, it may interfere with the contents of the bowel sufficiently to impair digestion and to cause biliary obstruction. Some investigators believe that the jaundice associated with movable kidney comes from a pull on the fixed, descending part of the duodenum and obstruction of the papilla of Vater.

REVIEW OF LITERATURE

The cases mentioned in Israel's book are those of Schmorl,[9] Jores[4] and Neumann.[8] In Schmorl's first case the autopsy of a fifty-eight-year old woman, who died of lung disease but showed evidence of cystopyelitis, disclosed a bacterial (B. coli) calculus in the kidney pelvis. In Schmorl's second case a woman of eighty-one years gave a history of cystitis. Following a kidney colic, bean-sized bacterial (B. coli) calculi were passed four days antemortem. Jores found the same picture *intra vitam* in urine and in a kidney colic. In Neumann's case pea to cherry-size concrements were found embedded in pus in the pelvis of a woman of twenty-six who had a nephrotomy. Microscopically and culturally these concrements were found to be composed of B. coli. Later, this patient showed a right-sided pyelonephritis.

Bornemann[1] described a case in a girl aged seven years with a history of whooping cough and colic. At the age of four years she had hematuria and intense pain. Blood clots were passed at the end of urination. The urine showed much albumin, pus, bacteria (cultured as B. coli) and casts, and X-ray examination disclosed shadows in each kidney pelvis. The child was treated medically and died. At autopsy a hard stone was found in each kidney pelvis, besides a large number of soft, laminated, spheroid concrements, the largest walnut-sized. Microscopical examination showed that the soft, laminated concretions in both pelves were composed entirely of B. coli, the segmental layers containing leukocytes, red blood cells and necrotic epithelial cells.

In a case reported by Ward,[10] the patient was a woman of thirty-five who had had malaria and typhoid as well as a history of bowel disorder. Fifteen months before coming to the author she had a severe right renal colic with hematuria which lasted a month, then another colic on the same side, accompanied by acute renal infection. X-ray examination showed a calculus. About a month later, that is about three months after the onset of symptoms, there were several mild attacks of colic during which forty-one "soft" stones were passed. Subsequently, the calculus seen by X-ray was eliminated, together with three others of the "soft" variety. Nearly 100 more soft stones were passed during the following ten months.

Ward found that a pyelogram showed the right kidney dropped and ureter kinked below the pelvis. Some months later there was another attack of persistent pyuria and obstruction of the right kidney with signs of inflammation, and the kidney was removed. The urine had shown abundant B. coli. The patient recovered. The removed kidney contained over 100 calculi, which, on examination were found to be of laminated structure and composed almost entirely of bacteria more degenerated toward the internal part of each lamella. From the chemical examination the nucleus of these calculi seemed to be a minute blood clot with the outer layers composed entirely of bacteria. The cementing layers appeared to be of a mucoid nature, which, Ward presumed, was the factor necessary for cohesion.

Kelly and Dible[5] observed a case in a woman of forty-two years. Her symptoms dated back to the age of eight years, when she was treated for some urinary condition. A few years later she had a

definite attack of pyelitis which involved the right kidney and, about ten years or so later, an attack of painless hematuria.

X-ray examination disclosed nothing, but by the cystoscope the presence of a calculus in the right ureter was diagnosed. Occasional attacks of hematuria followed but later X-ray examinations failed to locate the stone again, and it was presumed to have disintegrated. B. coli and blood were found in the urine, which also contained casts composed chiefly of bacteria. Exploration of the right kidney pelvis resulted in the removal of masses of calcareous and soft, friable material from the kidney pelvis (calcium oxalate and fibrin). This woman was ultimately nephrectomized in 1929 (fifteen years after the last cleaning out of the kidney pelvis), owing to agonizing pains and loss of right kidney function. The whole of the kidney pelvis and calices were tightly packed with soft, faceted, dark olive green masses. In some cases there was a very minute calcareous nucleus. Microscopically the concretions were made up of B. coli and a reticulum substance of the nature of fibrin which was about the masses of bacteria. The authors, however, think that this was not fibrin but largely composed of degenerate leukocyte cells. There was some kind of stratification of the outer layers, but this was entirely lacking toward the center of the concretions.

ETIOLOGY OF BACTERIAL RENAL CONCRETIONS

From a consideration of the cases quoted and of the literature, two questions arise in the etiology of this particular type of concrement: First, that of some kind of nucleus, and, second, that of some kind of cementing process which causes the masses of bacteria to adhere. There seems to be little doubt that the concretions develop by continual proliferation of live bacteria and the continual addition of cells to the exterior of the growing mass.

In regard to the nucleus, Lauda[6] postulated the presence of necrotic shreds cast off from the pelvic wall in pyelitis. Many of the cases gave the history of an old pyelitis, but, if this is to be considered as causative, the occurrence of bacterial concretions should be much more common than they apparently are.

Schmorl thought the first event to be a simple adhesion of bacteria to form small masses. The urine from infected renal pelves not infrequently contains clumped masses of bacteria; at times these

are sufficiently large to obstruct the ureteral catheter. It seems quite probable that a number of these clumps might coalesce and form the nucleus of a larger mass.

Bornemann discusses the similarity of fibrin stones and bacterial stones and concludes that they are identical. The nucleus of the concrements in Ward's case appears to have been a minute blood clot. Kelly and Dible conclude that the concretions were originally formed about tiny particles of stone or gravel.

The most important factor in these cases, however, appears to be the continuous deposit of bacteria in the kidney pelvis. This point, as well as the fact that the particular bacillus is almost always the B. coli, seems to have received very scant consideration from the authors. Ward thinks that in his case the bowel disorder may have been the source of the urinary tract infection and that the process was intensified by the presence of kidney ptosis and ureteral kink. The fact that all the cited cases were in women and that kidney ptosis is more common in the female sex may have some bearing in the matter.

There seems but little to support the theory that the cementing substance in the concretions is of a fibrinous nature; it seems more plausible to consider it to be a degenerated leukocyte product.

In my own two cases there was no evidence of a calcareous or fibrinous nucleus, nor did the urine contain fibrin shreds.

I do not wish to include in this report cases in which bacilli other than the B. coli were cultured from the kidney pelvis. Liebermeister[7] mentions three cases of tuberculosis of the kidney with calculus in which the tubercle bacillus was found in the stone, and Ferrier and Bliss[2] report a case of pyelithotomy complicated by a gas bacillus (B. Welchii) infection originating in the nucleus of a renal calculus.

CONCLUSIONS

Two personally observed cases of kidney pelvic concretions composed of bacteria (B. coli) are reported and some other cases reported in the literature are discussed. Continuous infection of the kidney seems necessary but it is likely also that some special circumstance is called for in order that a calculus of this type should be produced.

Bacterial concrements in the kidney pelvis may be concomitant with the usual type of indurated kidney calculus.

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SILENT RENAL STONES

REPORT OF TWO CASES

THOMAS F. LAURIE, M.D.
Syracuse, N. Y.

The following two cases are deemed of sufficient interest to warrant reporting them:

Case 1.—S. M., male, aged thirty-one, married, was referred to me by Dr. C. J. Laus with the diagnosis of large left renal calculus which was discovered during the course of a previous X-ray examination for gastro-intestinal disease. He had never had anything like renal colic. There had never been any pain, frequency, burning, nocturia or blood in the urine. His family history was negative. His previous history was one of gastric ulcer, the symptoms of which began at the age of twelve. He had had two operations for gastro-enterostomy, the first one at the age of eighteen, done in England, and the next one about two years ago. The patient "thinks" the ulcer was removed at the second operation. He was admitted to the General Hospital of Syracuse July 21, 1930, with definite signs of a bleeding ulcer and was under the care of Dr. Laus. He was discharged August 2, 1930, with careful instruction in ulcer management. I saw him first September 4, and made a cystoscopic examination. Owing to economic conditions he did not enter the hospital until December 3, 1930, for operation.

Physical examination was essentially negative. He was a small, fairly well-built man. Pupils were equal and reacted to light and accommodation; upper teeth were replaced by a plate, lowers fair; throat somewhat reddened. There was no glandular enlargement anywhere. Lung borders were normal, no dullness or râles heard. Heart sounds were clear. Blood pressure was 138/70. Liver and spleen were not palpable, no masses or resistance felt, and no tenderness. There was a midline scar. There was no edema of the extremities. Reflexes were present and normal. Cystoscopic examination revealed a normal bladder both as to appearance and capacity. Both ureters were easily catheterized. The flow of urine was clear and normal. No tubercle bacilli were found in either specimen, each showed an occasional leukocyte and rare red cell, no growth on culture from either side. Phenolsulphonephthalein appeared in two minutes from the right side and in three minutes from the left. X-ray examination showed a large coral calculus in the left kidney. A pyelogram made showed some

rounding of the calices but no evidence of marked kidney destruction.

Operation was performed December 4, 1931, using a left loin incision. The kidney was stripped of its fatty capsule and delivered out of the wound. An incision was made into the posterior aspect of the pelvis through which the larger part of the calculus was removed. A very small incision was made near the upper pole through which a small piece of the calculus was removed and a similar incision at the lower pole on the anterior surface for the same purpose. The kidney was replaced after closing these incisions and a cigarette drain

Fig. 1. Case 1. Large coral calculus in left kidney not infected.

placed down to the posterior aspect of the kidney. The wound was closed in layers. There was some drainage from the wound for the first week. The patient left the hospital December 18, 1931, with the wound closed.

Since this time the patient has made a good recovery and was able to resume his usual work two weeks after leaving the hospital. An examination was made May 1, and a pyelogram of the left side secured which is here shown.

Chemical analysis of the stone showed that it consisted of pure cystin.

Case 2.—G. J., male, aged twenty-four, was admitted to the Urologic Service of the General Hospital of Syracuse with the story that he

had noticed his urine was more cloudy than usual for the last three months.

There was no dysuria, nocturia, tenesmus or any other symptoms referable to the urinary tract. He had had measles, tonsillitis once four or five years ago. He denied venereal diseases by name or symptom. He had had no operations or minor injuries. He had pleurisy of the left chest (his own diagnosis), not ill in bed, three years ago. During the last eight or nine months he had lost about 15 pounds in weight but this had been regained during the last two months. He had recently noticed that he tired more easily than usual.

Fig. 2. Case 1. Pyelogram before removing calculus.

Fig. 3 Case 1. Pyelogram made five months after operation for removal of calculus.

Physical examination revealed a rather slender man well developed, ambulatory, and apparently well. Blood pressure was 130/75. Head, ears, and oral cavity were negative. Pupils were normal. The chest showed some supra- and infra-clavicular wasting; there was some fullness over the right apex anteriorly and posteriorly. There was some cardiac hypertrophy but no murmurs were heard. There was no abdominal tenderness, no tenderness in the costo-vertebral angles. The prostate by rectum was soft; no masses, not enlarged. Patellar reflexes were sluggish. The urine was cloudy, amber, acid, specific gravity 1.015, albumin 1 plus to 3 plus, pus 4 plus, rare red cell. Blood count was hemoglobin, 85 per cent; red cells, 4,370,000; white cells,

9,700; eosinophils, 2 per cent; neutrophils, 79 per cent; lymphocytes, 19 per cent; N. P. N., 38. Wassermann test was negative. P. S. P. was 85 per cent.

X-ray film showed a large branched calculus in the left kidney and another in the lower end of the left ureter near the bladder. X-ray of the chest suggested an old fibrous tuberculosis probably dating back to childhood. There was no positive evidence of any acute infection.

Cystoscopy was done January 13, 1931. A No. 24 F. cystoscope easily entered the bladder, the capacity of which was normal.

Fig. 4. Case 2. Large calculus in left kidney and in lower end of left ureter.

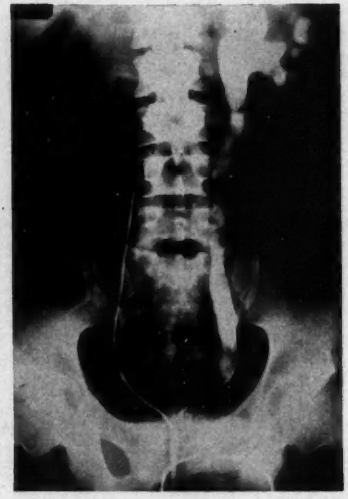

Fig. 5. Case 2. Ureteropyelogram showing dilated ureter and hydronephrosis.

There was a small papilloma just over the left ureteral orifice. The right ureter was catheterized with a No. 6 F. catheter. On the left side an obstruction was encountered about 3 cm. from the bladder and a No. 6 F. catheter could not be passed. A No. 5 F. catheter was introduced past the obstruction with difficulty. The urine from the right side was clear and contained a few red blood cells showing no evidence of infection. The urine from the left side was very cloudy, containing much pus. No tubercle bacilli were found in either specimen. A pyelogram was made on the left side and this showed a marked hydronephrosis and hydroureter with a large calculus in the kidney and one in the lower end of the left ureter.

Left nephrectomy under spinal anesthesia was performed January 19, 1931. The usual loin incision was made, kidney exposed and the fatty capsule separated with difficulty owing to perinephritis. The kidney was found to be rather distended with fluid, which was removed with a cannula. The parenchyma was thin, the kidney was delivered and a clamp placed on the pedicle. Two chromic gut ligatures were placed proximal to the clamp and the kidney removed. Owing to a very short pedicle it was considered advisable to leave the clamp on. There was a drain placed down to the pedicle and the

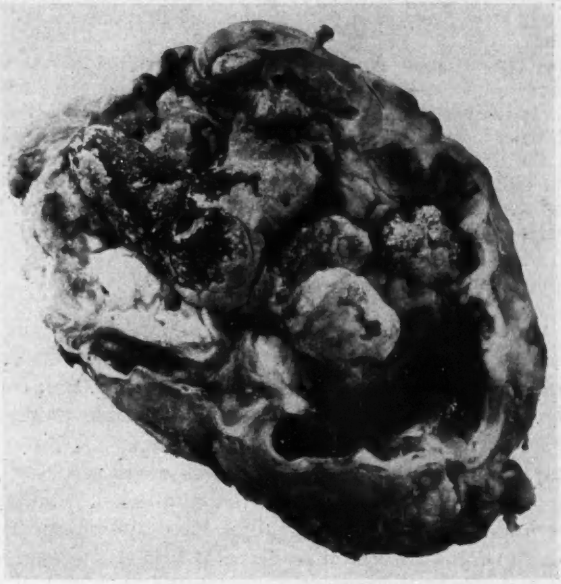

Fig. 6. Case 2. Specimen after removal.

wound was closed in layers. The clamp was removed at the end of forty-eight hours and the patient made a good recovery, leaving the hospital four weeks after admission with the wound closed.

The patient was re-admitted to the General Hospital March 31, 1931, with the following history: A physician was called to see the patient that morning and found him suffering with sharp right renal colic. He had not passed any urine in several hours. An anodyne was administered and he was admitted to the hospital early in the afternoon. Urethral catheterization was done but no urine was obtained.

A plain X-ray film was made and this showed two shadows in the region of the right kidney, one of which was apparently in the ureter. These did not show on our previous films. Cystoscopic examination was made and corkscrew filiform catheter size No. 6 F. passed up the right ureter. An obstruction was encountered at about 25 cm. from the bladder but after manipulation the catheter passed on to the kidney with a very profuse flow of urine. The catheter was then strapped in with adhesive. The next day another film was taken and it showed that the stone which was apparently in the ureter had been pushed back into the kidney pelvis. The patient's pain was relieved almost immediately after passage of the catheter, which was removed in forty-eight hours.

He was operated on April 6, 1931, under spinal anesthesia. The right kidney was exposed by the usual incision and after freeing the capsule was delivered into the wound. A small X-ray film was made and both calculi were found to be in the pelvis. A small incision was made in the anterior surface of the pelvis and the stones delivered. This was closed, the kidney replaced with a cigarette drain to the pelvis and the wound closed in the usual manner. He had an uneventful convalescence and left the hospital May 2, 1931, with the wound closed.

COMMENT

Here we have two cases of large coral calculi in the kidney, neither one with symptoms which would attract attention directly to pathology presented. One case was absolutely uninfected and the other markedly so. In Case 1 it was possible to remove the calculus and leave a good functioning kidney. In Case 2 a nephrectomy was necessary. Also in this case the renal colic which came on in the remaining kidney necessitating a pelviolithotomy was a serious complication and might have altered the treatment had these small calculi been discovered at first.

HEMANGIOMA OF THE KIDNEY

A REPORT OF TWO CASES AND A BRIEF RÉSUMÉ OF THE LITERATURE

DAVID W. MACKENZIE AND ALLAN B. HAWTHORNE

From the Department of Urology Royal Victoria Hospital, Montreal

Hemangioma of the kidney is exceedingly rare, and although belonging to the class of benign tumors, it frequently requires immediate and radical measures in its treatment.

It is extremely difficult to diagnose and the majority of cases have been diagnosed as such by the pathologist.

The greater part of the literature on this subject is made up of case reports, and Judd and Simon in 1928 were the first to review these. Since then some ten or twelve cases have been added to the list.

Mackey in 1930 is the only one who has written at length on the subject, and, apart from reviewing the cases to date, classifies them according to their location in the kidney: (a) Renal pelvis, (b) renal cortex, (c) renal medulla.

The cases collected in 1928 by Judd and Simon were reported by: Deansley, Fenwick (2), Lutz, Rovsing, Rolleston and Kanthack, Morris, Sennels, Stieda, Swan, Virchow, Judd and Simon.

Additional cases collected by Bailey in 1930 were reported by: Cabot, Begg, and Gile.

Still further additions were made by Mackey in 1930, these being the cases reported by: Kydd, Suter, Jenkins and Drennan, Wheeler, Simpson, Newman, Jacobs and Rosenberg, and Mackey.

One of our present cases was included in a list of renal tumors published by the author in 1929, and is listed by Mackey. The details of that case and also a second one, we are now reporting for the first time.

Case 1.—Mr. H. L., aged thirty-five years, was admitted March 17, 1924, with the following complaints: (1) Hematuria of ten days' duration; (2) slight attack of pain in left lower quadrant of abdomen, and (3) general weakness for the past two weeks.

The patient first noticed blood in the urine ten days previous. This was well mixed with urine, which was bright red in color and without any clots. He did not feel sick at this time but had complained of general weakness for about a week before he noticed the hematuria.

The day after the onset of the hematuria he had an attack of pain in the left lower quadrant of the abdomen, which radiated to the left groin and left side of the scrotum. The attack lasted about an hour and did not recur.

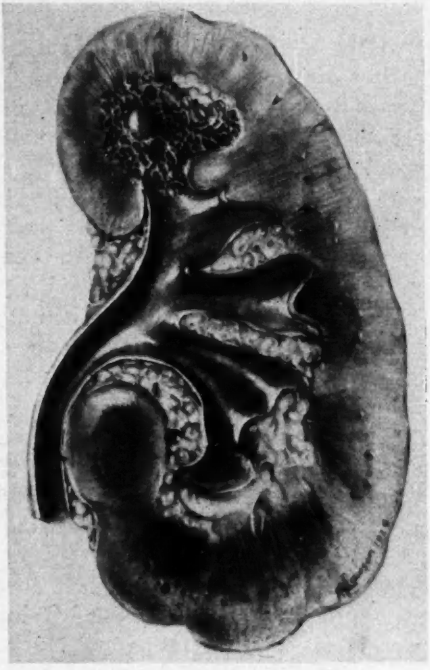

Fig. 1. Specimen in Case 1 showing gross lesion of medullary portion in upper pole of the kidney, involving the superior calix.

There was no history of frequency or dysuria nor had he passed any gravel in his urine at any time. There was no previous history of hematuria.

Personal and family history was negative.

The patient was a moderately well nourished and well developed male. There was no jaundice present nor noticeable anemia. Cervical,

axillary and inguinal glands were palpable. Epitrochlear glands were not palpated. The thyroid gland was not enlarged.

The chest was of normal contour and expansion. Tactile fremitus was normal. Percussion was normal. Breath sounds were vesicular in character with no râles present.

The tongue was clean and moist. Teeth were in good condition. The abdomen was moderately full and rounded. Solid organs were not palpated. There were no areas of tenderness nor abnormal masses palpated.

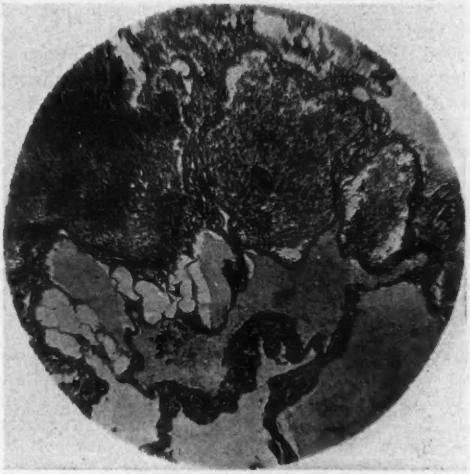

Fig. 2. Low power microphotograph of Figure 1 showing dilated cavernous sinuses typical of angioma.

The pulse was regular with good volume, artery wall was not thickened. Blood pressure was 135/85. The heart was within normal limits. Sounds were well heard, regular, good volume. There was a soft systolic murmur at the apex—transmitted to the axilla.

The pupils were equal in size, normal in outline, reacted equally to light and accommodation. Superficial reflexes were present and equal. There were no pathological reflexes present.

The locomotor and integumentary systems were normal.

There was no costo-lumbar tenderness. The kidneys were not palpated. There was no tenderness along the course of either ureter or over the suprapubic area. The penis, scrotum and contents were normal. The prostate per rectum was smooth and soft, normal to palpation. The seminal vesicles were not palpated.

Laboratory findings March 17 were: Catheter specimen urine—dark brown, cloudy; acid; 1.021; albumin, 0; sugar, 0; red blood cells, ++++; few pus cells; no casts.

March 18, skiagraph of the kidney and bladder did not show any shadows suggestive of calculi. Phenolphthalein test, 1 c.c. intramuscularly, first hour was 50 per cent; second hour, 18 per cent; total two hours, 68 per cent. Blood Wassermann was negative. Smear of bladder urine was made. No acid-fast bacilli were found. Blood urea was: .43 gms. per liter; blood urea nitrogen, 20.3 mgms. per 100 c.c.; blood creatinin, 1.15 mgms. per 100 c.c.

Cystoscopy was performed March 18, 1924. The instrument was easily introduced. Bladder mucosa was normal. There was no tumor or foreign body seen. Both ureteral orifices were normal in contour and position. There was slight redness about the left orifice. Both ureters were easily catheterized to renal pelves and specimens obtained for examination and culture.

	RIGHT	LEFT
Macros:	Amber, hazy	Hazy, muddy
Vol.	1 c.c.	3 c.c.
Urea:	0.016 gms. c.c.	0.014 gms. c.c.
Micros:	Scattered W.B.C. Scattered R.B.C. Epith. cells	Pus x. Epith. cells R.B.C. +++
Culture:	No growth No acid-fast bacilli found	No growth No acid-fast bacilli found

X-ray film with both catheters in position showed catheters well up to the level of the junction of the second and third lumbar vertebræ. There was no evidence of calculus.

Skiagraph with 6 c.c. 12 per cent sodium iodide in the left catheter showed a dilated renal pelvis with distorted, irregularly placed and shaped calices at the level of the second and third lumbar vertebræ.

March 21, urine voided postoperatively showed dark amber color; cloudy; acid; 1.027; albumin, trace; sugar, 0; red blood cells, scat-white blood cells rare; epithelium.

April 6, urine (voided) was light amber; acid; 1.022; albumin, 0; sugar, 0; white blood cells, rare; epithelium.

A left nephrectomy was performed for hematuria, using the left loin incision. The muscles were incised, nerve retracted backwards, fascia incised. There was a moderate amount of perirenal infiltration. The kidney was easily exposed; the ureter freed, clamped, ligated and cauterized. The pedicle was freed, clamped and cut. The kidney was removed and the pedicle ligated. The wound was closed in the usual manner, a rubber tube drain being used. The cut surface of the kidney showed hemorrhagic areas just beneath the mucous membrane of the upper calix.

Pathological Report.—Specimen consisted of a kidney showing fetal lobulation; capsule strips easily, exposing a smooth surface. The cut surface showed normal markings and a dark hemorrhagic area at the upper pole. Section through the hemorrhagic area showed it to be made up of larger and smaller blood channels, lined with endothelial cells and containing red blood cells. Between these channels there was a fibrous connective tissue stroma, in some places abundant; in others scanty.

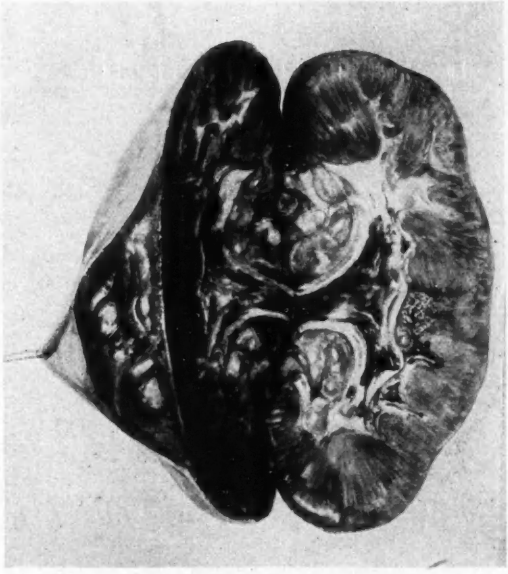

Fig. 3. Specimen in Case 2 showing marked submucosal hemorrhages, also angioma of the cortex, which extended through the medulla of the kidney to the pelvic wall.

Diagnosis was hemangioma.

Convalescence was uneventful. The patient was discharged April 6, 1924, and has enjoyed perfect health since.

Case 2.—Mr. J. B., age thirty years, was admitted April 26, 1929, with the following complaints: (1) Hematuria; (2) pain in the left groin; (3) burning on urination.

The patient had an attack of hematuria eight years ago. This lasted

several days but passed off without any other symptoms. There was no recurrence until ten days ago, when he noticed blood in the urine. There were no other symptoms until two days later, when he suffered from an acute attack of pain in the left lower quadrant of the abdomen. The pain radiated downward to the genitals, and accompanying the attack was a certain amount of shock but no vomiting. Since the onset of the hematuria, the patient has noticed an increasing burning on urination. There were no other urinary symptoms.

Past history revealed no previous illnesses, and the patient denied venereal disease.

Family history was negative.

The patient was a well developed and nourished male. There were no signs of gross abnormalities; no jaundice nor anemia.

There was equal expansion of the lungs on both sides. Tactile fremitus was normal. Percussion was resonant over both lungs. Auscultation gave normal breath sounds. Voice sounds were well transmitted.

The pulse was regular in rate and rhythm. Heart sounds were distant but clear. There were no valvular lesions. Blood pressure was 130/75.

There was a definite but slight left-sided tenderness, about half way between the umbilicus and the anterior superior iliac spine. No masses or viscera were felt. There were no scars or rigidity.

Pupils reacted to light and accommodation. Biceps, triceps and patellar reflexes were present. There was no Romberg's sign; no ankle clonus. Plantar flexion was present.

The integumentary system and lymphatics were normal.

There was no costovertebral tenderness. The kidneys were not palpated. There was slight tenderness in the left lower quadrant of the abdomen. There was no distention of or tenderness over the bladder; no inflammation or discharge of the urethra; not catheterized. The penis was normal. The scrotum and contents were normal. The prostate per rectum was normal. The seminal vesicles were not palpated.

Laboratory Findings.—April 26, the urine (voided specimen) showed: Red cloudy; acid; 1.010; red blood cells, ++++; albumin, present; sugar, none; casts, none; epithelium. April 26 the urine was too red for phthalein test. May 5, postoperative, the urine showed: amber clear; 1.022; acid; very occasional white blood cells; albumin, none; sugar, none; epithelium, occasional red blood cells. X-ray examination showed the heart, aorta and diaphragm, and trachea to be negative. The lungs were negative for tuberculosis.

In cystoscopic examination the instrument was easily introduced. Bladder mucosa was normal. There was no tumor or foreign body seen. The right ureter was normal in contour and position, with clear urine discharging. The left ureter was normal in contour and

position, but was freely discharging blood. Both ureters were easily catheterized to the renal pelves and specimens obtained.

	RIGHT	LEFT
Macros:	Watery, clear	Red, cloudy
Vol.	½ c.c.	¾ c.c.
	No. R.B.C.	R.B.C. +++
	No W.B.C.	
	No casts	
	Epithelium	

X-ray film with catheters showed catheters in normal position, no adventitious shadows.

Pyelogram, right, with 2 c.c. 12 per cent iodide, showed a perfectly normal renal pelvis with a somewhat indistinct kidney shadow of normal size. Pyelogram, left, with 6 c.c. sodium iodide, 12 per cent, showed a markedly flattened middle calix—upper and lower calices normal, good left kidney shadow present.

Left nephrectomy for tumor of the kidney was performed May 14. The curved left loin incision was used, the muscles incised, perirenal fatty capsule opened, and the kidney freed. There was a marked adherent portion about the center of the kidney on the dorsal surface, the size of a silver dollar. There was also some depression here with dark discoloration. A very small ureter was ligated and severed with the cautery. Pedicle was clamped, cut and ligated. The wound was closed in the usual manner with a small cigarette drain. General condition of patient was good.

Specimen showed a moderate sized kidney, both poles normal, with this dark retracted area about the center on the dorsal surface. On section the kidney pelvis seemed a counterpart of the pyelogram. About the intrusion on the center portion of the pyelogram on the outside was a dark, old blood colored, spongy area, resembling angioma.

Pathological Report.—Specimen consisted of the left kidney, 11.5 cm, in length. The true capsule was apparently normal, and stripped readily, revealing two reddish retracted areas, the larger the size of a shilling and the smaller the size of a cent. On section the cortex measured 0.6 cm. The consistency was firm. The cortex in the regions above mentioned was slightly firmer and darkish brown. There was present in the medulla near the pelvis a reddish hemorrhagic area.

Sections of the hemorrhagic area in the pelvis showed it to consist of larger and smaller closely packed, dilated, venous sinuses, filled with blood. Sections of the retracted areas described grossly showed what appeared to be an area of infarction, with collapse of the parenchyma, distorted blood channels and cellular infiltration and fibrosis.

Diagnosis was cavernous hemangioma.

Convalescence was uneventful. The patient was discharged May 22, 1929, and has enjoyed perfect health since.

Angioma of the kidney may occur in the wall of the pelvis, the medulla or the cortex. It is usually small and circumscribed, with no tendency toward infiltration. It is usually single, though multiple angiomata have been noted.

Clinical symptoms in these cases arise solely from hemorrhage and are due to ulceration into the pelvis of the thin walled vessels. Colicky pain from the passage of clots, marked anemia from persistent bleeding and even shock and collapse have been seen in some cases. These symptoms are naturally more often noted in cases involving the pelvis and medulla and only rarely in an angioma of the cortex.

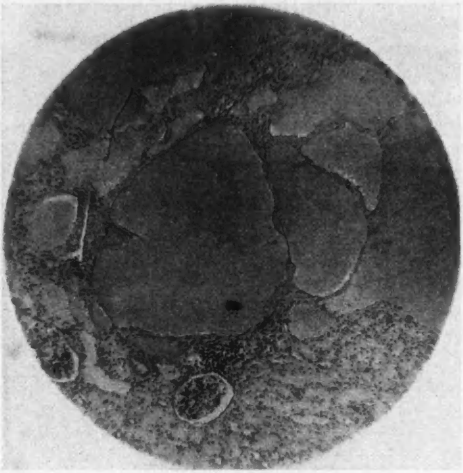

Fig. 4. Low power microphotograph of Case 2 showing large cavernous sinuses, with narrow fibrous walls, filled with blood cells.

The pre-operative diagnosis of an angioma of the kidney is difficult to make. There is nothing in the history, in the symptoms, or in the findings that will make a positive diagnosis of angioma possible. Many of the cases have been considered as an essential hematuria, especially those with comparatively little deformity in the pyelogram.

Jacobs and Rosenberg, and also Jenkins and Drennan, claim, after examination of the pyelograms in their respective cases, that a certain mottled appearance, due to the entrance of pyelographic fluid in the angiomatous spaces, would be sufficient grounds for a diagnosis. The great difficulty in this interpretation would be the deformity caused by the retention of blood clot in the pelvis.

The pathological picture of an angioma is that of a benign tumor, in which the formation of blood vessels constitutes the essential character of the growth.

Oertel holds that they develop by the budding of endothelial cells from an originally normal focus, or more frequently from an embryonic faulty over-production of blood vessels in a part—hamartoma.

The mature angiomata show more or less fully developed vessels, surrounded and held together by a greater or lesser amount of connective tissue.

It is difficult to explain the late appearance of some of these lesions, unless it be that angiomata vary in the stages of their activity, some enlarging early in life, and others after long periods of quiescence.

The treatment in these cases varied.

Several were treated symptomatically and as essential hematuria, and the pelvis was lavaged with silver nitrate solution. Nephrotomy and decapsulation have been attempted without satisfactory results. Eventually nephrectomy was carried out in twenty-three of the twenty-five cases collected, some to relieve a prolonged renal hemorrhage, others on the diagnosis of renal tumor.

SUMMARY

Hemangioma of the kidney is rare. It is usually single, though cases of multiple hemangiomata have been reported.

The angiomata may be situated in the pelvis, medulla or cortex, though the latter are seldom seen.

The lesion is composed of large cavernous sinuses, lined with endothelium and filled with blood.

Injury and ulceration play a part in the onset of hemorrhage, the only constant clinical symptom.

The diagnosis is seldom correctly made and nephrectomy so far is the only satisfactory method of treatment.

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FIBROBLASTOMA (FIBROMA) OF THE KIDNEY

A REPORT OF A CASE WITH A REVIEW OF THE LITERATURE

HERMAN L. KRETSCHMER, M.D.

From The Presbyterian Hospital of Chicago and Rush Medical College of The University of Chicago

Small fibromata under the capsule, in the cortex, or in the medulla at the bases of the pyramids are not infrequently found in the routine examination of the kidney at autopsy, but they occasion no sign or symptoms during life. According to Ewing, they have their origin in disturbances of development. Genewein (quoted by Ewing) is of the opinion that they are not true neoplasms but tumor-like nodules arising from superfluous tissue (Albrecht's hematoma).

There are, however, very few cases recorded of renal fibromata which have attained a size large enough to be of clinical significance. Because of the great rarity of this type of renal tumor, it seems desirable that the following case be placed on record.

CASE REPORT

I. W., male, aged thirty-eight years, was admitted to the Presbyterian Hospital, July 28, 1930.

Six years previous to admission to the hospital, the patient passed gross blood in the urine. One week later he had an attack of severe pain over the region of both kidneys. Several such attacks occurred, and about two months later a stone was passed.

Eight days before admission to the Presbyterian Hospital, the patient noticed blood in the urine and consulted his family physician, who told him his urine contained blood. There were no urinary symptoms, the presence of painless and symptomless hematuria being the only indication of a urinary disturbance.

Physical examination showed the pupils were equal and reacted to light and accommodation. Teeth showed much dental repair. Tonsils were negative, as were the heart and lungs. The liver was palpable at the costal margin. The spleen and kidneys were not palpable. Examination of the external genitalia and the rectal examination were both negative.

Blood examination showed: Red cells, 5,000,000; leukocytes, 11,450; hemoglobin, 85 per cent. Blood pressure was: Systolic, 131;

diastolic, 80. Blood chemical examination showed; Urea nitrogen, 12.9; uric acid, 3.8; creatinin, 1.4; non-protein nitrogen, 35.5. Wassermann test was negative.

Roentgen-ray examination was negative.

Urinalysis gave albumin, 0; sugar, 0; blood, 0; casts, 0; leukocytes, 0.

Fig. 1. Right pyelogram showing a filling defect compatible with tumor.

Cystoscopic examination showed the bladder to be normal. Both ureters were catheterized without difficulty or obstruction. Examination of the urine obtained at this time showed:

	Leukocytes per Cu. Mm.	Cultures	Tubercle Bacillus
Bladder	18	Sterile	0
Right Kidney	62	Sterile	0
Left Kidney	75	Sterile	0

Phthalein test for the first half hour was 60 c.c., 54 per cent; second half hour, 175 c.c., 14 per cent; third half hour, 80 c.c., 24 per cent.

Pyelogram of the left kidney was normal. The right (Fig. 1), showed a filling defect compatible with tumor.

Diagnosis was tumor of the right kidney. Nephrectomy was advised.

Operation, right nephrectomy, was performed under ethylene anesthesia, July 30, 1930.

The patient made an uneventful recovery and left the hospital, August 13, 1930.

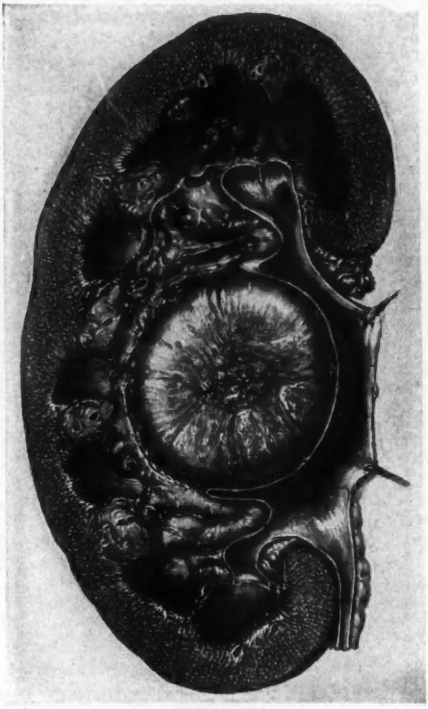

Fig. 2. Showing the presence of the fibroma with compression of the pelvis.

Gross and microscopic description of specimen (Dr. E. R. Le Count).—The kidney was about normal size, 12 × 6 × 5.5 cm. The pelvis was distended by a tumor 43 × 41 × 35 mm., shaped a little like a thick lens. The attachment of the tumor occupied about one-sixth of its outside and was almost altogether to the ventral half of the kidney. It was a loose attachment, close to the large renal vessels at the root

of the kidney, and all around the tumor there was peripelvic fat (Fig. 2).

A thin capsule, less than a millimeter thick, surrounded the tumor and in sections made by cutting the structure was a radial one; fine wavy lines extended from all parts of the periphery towards the center. The growth was compact, firm and gray-white tissue. There was very little compression of the renal substance by the tumor. Most of the lining of the pelvis was red with hemorrhage.

Fig. 3. In the paler regions the fibroblasts and cells are spread apart by edema. The darker half is mainly collagen fibers stained with phosphotungstic acid hematoxylin.

Histology.—In sections from the deeper portions, sections equal to about 20 sq. mm., two large and several small pale spots with poorly defined outlines were present; the rest of such sections was more solidly pink (hematoxylin and eosin). These pale places (Fig. 3) were regions where edema had so split apart the various constituents of the growth that the condition was virtually one of exquisitely teased-out tissue in which large fibroblasts and collagen fibrils prevailed, with occasional lymphocytes.

The denser places with no edema presented the usual structure of fibroblastomas, with a great variety in the quantity of collagen. Where this material was most abundant, the bands, somewhat narrower than skeletal muscle cells, were 0.35 mm. long. Many of the blood vessels

in the growth had a wall of a single layer of cells (Fig. 2) differing in no marked way from the fibroblasts. The nuclei of the fibroblasts, seen from the flat sides (Fig. 4) were 8 to 16 microns in diameter, the average about 11 microns. The chromatin was in fine granules, like dust, the nucleoli small and frequently two in number, the nuclear membranes very thin.

The cytoplasm for these nuclei was rarely visible, but when found was irregular and spread out as broad masses about the nuclei, polygonal and with pointed corners. Where the cells were in profile (Fig. 4), the cytoplasm was more readily seen. In such cells it extended only a short way beyond the nuclei and tapered out to two sharp points opposite one another at the poles of the nuclei. For some such cells in profile, the cytoplasm was found at only one end of the nuclei. Except where the edema was very marked the cells were in intimate contact with collagen fibrils.

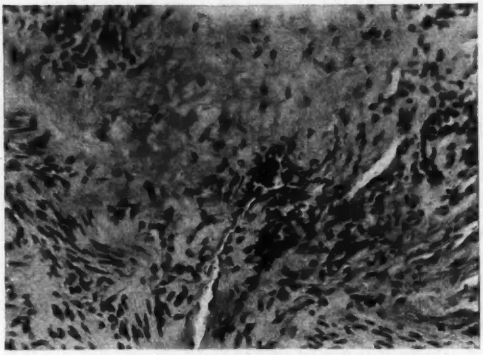

Fig. 4. A collapsed empty blood vessel is in the center of the top. On the left side of this are many fibroblasts with the nuclei flat, seen from the sides, so they appear oval and faintly stained. On the right of the vessel the nuclei of many fibroblasts lie edgewise, are darker, slightly wavy, and in places parallel.

In places at the periphery of the growth, the collagen was very abundant, the fibroblasts few and far apart. There were only a few very delicate strands of elastic tissue present, and apparently there were no smooth muscle cells whatsoever in the tumor.

Large renal fibromata are also extremely rare, and on account of their rarity they may be considered curiosities, both from a clinical and pathological standpoint.

Israel in his "Monograph on Surgery of the Kidney and Ureter" stated that seldom indeed do fibromata require surgical treatment.

Albarran and Imbert, in a study of 529 cases collected from the literature, found two renal fibromata. Kukudshanoff, in a series of seventy-eight renal tumors reported from the Clinic of Fedorow over a period of twenty-five years, found one fibroma. Hyman found no fibromata in a group of ninety-nine tumors. Nichols presented a series of forty-seven renal tumors, five of which were benign, but there were no fibromata in this group.

MacKenzie and Parkins, in a series of fifty-six renal tumors in adults, found thirteen to be benign, including cysts, and two fibromata. Eusterman found no instance of such tumors in a series of fifty-six neoplasms.

Baumgartner, in a series of 400 autopsies, found five cases of small nodules of fibrous tissue in the kidney which had caused no symptoms during life, and Brites found twenty-two such instances in 119 postmortem examinations.

HISTORICAL REVIEW

The recorded cases of pure fibromata of the kidney are indeed few, and the literature regarding them scanty.

Dickinson, in 1862, reported the finding of a "fibro-fatty" tumor of the kidney to the London Pathological Society. Morris states, however, that in later years, with improved pathological technic, Dickinson re-examined the neoplasm and decided that it was a sarcoma.

Brodeur, in 1886, in his book on the "Surgical Conditions of The Kidney," includes a chart of ten benign renal tumors that he had gathered from the literature, and of these, five cases (Bruntzel, Thomas, Wahl, Claus, Park) appear to be pure fibromata.

In 1896 Kuster stated that at that time there were eight reported cases of renal fibromata in the literature. He does not, however, give the names of the authors, dates or places of reports of these tumors.

In addition to the cases reported by Brodeur, cases of renal fibro-

FIBROMA OF THE KIDNEY

No.	Author	Age	Sex	Chief symptoms	Duration	Clinical diagnosis	Treatment	Location	Outcome	Comments
1	Wilks 1869	53	M	Intermittent pain in loins and hematuria Abdominal tumor right side	10 yrs. 6 yrs.	Kidney stone or cancer	No operation Autopsy specimen	Right kidney	Death with uremic symptoms	Tumor discovered at autopsy. Covered by kidney capsule which it had gradually distended. Destruction entire kidney substance by compression.
2	Bruntzel 1882	33	F	Large abdominal tumor	5 yrs.		Nephrectomy	Left kidney	Recovery	Tumor arose from kidney capsule —weighed 20 pounds.
3	Thomas 1882	21	F	Abdominal tumor size of 8 mos. pregnant uterus		Ovarian tumor	Nephrectomy	Lower pole left kidney	Recovery	Tumor arose from kidney capsule. It showed much cystic degeneration.
4	Claus 1885	46	F	Abdominal tumor right side		Ovarian cyst	Nephrectomy	Right kidney	Recovery	Tumor developed between cortical and medullary portions.
5	Wahl 1885	11		Abdominal tumor	6 yrs.	Benign renal tumor	Nephrectomy	Lower pole of right kidney	Recovery	Tumor arose from kidney capsule. Shortly before tumor was noticed received trauma to abdomen (fall).
6	Park 1886	2		Enlargement right side of abdomen, palpable tumor	Since few mos. after birth	Tumor of right kidney	Nephrectomy	Right kidney	Condition good 7 mos. later	Weighed 4 pounds. Showed extensive cystic changes.
7	Clark 1923	28	F	Pain (right side). Mass size of tennis ball (right kidney region).	1 yr.	New-growth of some kind	Nephrectomy	Right kidney	Condition good 13 mos. later	No urinary disturbances were shown.
8	Kukudshanoff 1928	36	F	Anemia and large palpable left kidney	5 yrs.	Neoplasm of left kidney	Nephrectomy	Left kidney	Recovery	Tumor imbedded in kidney and revealed by sectioning. It measured 12 by 8 by 6 cm.
9	Boross 1929	23	M	Hematuria			Nephrectomy		Recovery	Pediculated in kidney pelvis.
10	Steinle 1929	28	M	Left lumbar pain Profuse hemorrhage from left ureter, renal colic	6 wks. Shortly before operation	Renal neoplasm	Nephrectomy	Left kidney, upper pole	Recovery	
11	Kretschmer 1931	38	M	Hematuria was the only complaint	8 days	Tumor of right kidney	Nephrectomy	Right kidney in hilus outside but adjacent to pelvis	Recovery	Gave history of having passed a stone about 6 yrs. previous to coming under observation.

mata have been reported by Wilks, Clark, Steinle, Boross and Kukudshanoff.

Thus, with the addition of the case reported in this paper, there are available for study, records of eleven cases of pure renal fibromata.

Great care was taken to exclude from this series the numerous cases of tumors which contain other elements besides fibrous connective tissue (chondro-fibromata, osteo-fibromata, fibro-lipomata, fibro-adenomata, etc.). Nor was it possible to include these fibromata, which are merely mentioned in the classification of types in series of renal neoplasms, to the effect that in a given series a fibroma was found but the clinical data were lacking.

PATHOLOGY

Renal fibromata may take their origin from any portion of the kidney.

The tumor had its origin in the kidney capsule in three cases; the upper pole in one case; gradually distended the kidney capsule, destroying by pressure the kidney substance, but preserving in general the normal kidney contour in one case; the tumor developed between the cortical and medullary portions in one case; in one case which was pediculated, the tumor hung into the renal pelvis; in one case the tumor was "imbedded" in the kidney; in my case the tumor occupied the middle third of the kidney, in the ventral half; in two cases the origin was not given.

These fibromata have been described as having the same firm consistency and homogeneous grayish-white appearance typical of this type of tumor. They are frequently mentioned as having undergone mucoid and pseudo-cystic degeneration in portions.

Microscopically, they are seen to consist of fibrous connective tissue, but show no special characteristics.

The right kidney was the site of the growth in five and the left in three cases; in the case herein reported the tumor was located in the right kidney, and this information was not given in the other reports.

ETIOLOGY

Ewing states, with regard to fibromata of the kidney, that "these growths must owe their origin to some developmental disturbances of the kidney." In this regard we may mention that in the case re-

ported by Park, the tumor occurred in a child of two years and in Wahl's in a child of eleven.

Garceau is of the opinion that the fibromata which become important clinically have their origin in the small fibrous nodules which have previously been mentioned and are not infrequently found at autopsy. These nodules "may become active and attain a large size."

AGE

The youngest age of occurrence in this series was two years (Park) and the oldest fifty-three years (Wilks). Two occurred before the age of twenty, four between twenty and thirty, two between thirty and forty, one between forty and fifty, and one after fifty. The patient reported in this paper was thirty-eight.

SEX

In five cases the tumor occurred in females and four cases in males, including the case herewith reported. The sex is unknown in the other case reports.

SYMPTOMS

As observed by Stillman, Morris, Clark and other authors, renal fibromata usually cause neither signs nor symptoms by which to render themselves apparent clinically until they have attained a large size.

In eight out of eleven of the recorded cases the presence of an abdominal tumor has served to direct the patient's attention to the condition. In size the tumor has varied from that of a tennis ball (Clark) to that of an eight months' pregnancy (Thomas), or the entire abdomen from the xiphoid to the brim of the pelvis is filled (Bruntzel).

Pain is a frequently mentioned symptom and was present in the cases of Clark, Steinle and Wilks. MacKenzie and Parkins state that pain and the palpable abdominal tumor were present in both their cases.

By many of the authors mention is made of the fact that the urine showed no abnormal findings and the patient was free of urinary disturbances. In my case, however, the patient had an attack of profuse painless hematuria, and it was for this reason that he consulted his physician.

Steinle's case is unusual in that it, too, presented a profuse renal hemorrhage and severe renal colic. Intermittent hematuria over a period of ten years was present in Wilks' patient. MacKenzie and Parkins remarked that hematuria was never present in their two cases and they suggested that the lack of hematuria might serve as a distinguishing feature to differentiate this benign tumor from a malignant growth.

In two cases, renal fibromata were incorrectly diagnosed as ovarian cysts; in seven cases there was a diagnosis of a renal neoplasm, and in two cases no diagnosis of renal neoplasm was made.

One outstanding feature of these tumors is their long history: five years in Bruntzel's case, six years in Wahl's and ten years in Wilks'.

Steinle's patient, who came to operation within six weeks after the onset of symptoms, the operation being preceded by severe hemorrhage and renal colic, had a clinical course of acute symptoms more pronounced than in any of the other recorded cases.

Because some of the cases were reported many years ago, these patients were not given the benefit of modern urological diagnosis; for example, cystoscopy, ureteral catheterization and pyelograms. A pyelogram made in the case herewith reported showed a filling defect compatible with tumor, but it gave no clue regarding the nature of the tumor.

TREATMENT

Of these eleven cases nephrectomy was done in ten cases. If it were possible in some of the cases to recognize the fact that one is dealing with a benign tumor, it might be possible to remove the tumor and to spare the patient a nephrectomy.

PROGNOSIS

It would seem from the study of the literature that fibromata of the kidney offer an extremely favorable prognosis. In the cases studied, a favorable outcome has been reported in every instance except in Wilks' case, where, in spite of the known presence of an abdominal tumor for more than six years, surgical intervention was not attempted, and the patient died of symptoms of uremia. MacKenzie and Parkins state that the cases of renal fibromata occurring in their series terminated favorably. Brodeur and Morris are

of the opinion that this type of tumor is clinically as well as pathologically benign.

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PAPILLARY ADENO-CARCINOMA OF THE RENAL PELVIS

REPORT OF A CASE. REPORT OF PROGRESS IN CASE REPORTED BEFORE THIS ASSOCIATION IN 1928

GEORGE R. LIVERMORE, M.D.
Memphis, Tennessee

The case of papillary adeno-carcinoma of the renal pelvis herewith reported is the second that has occurred in my practice in the past two and one-half years. In this case the ureter was not removed, due to the condition and age of the patient, and since his recovery from nephrectomy he has never returned for a ureterectomy. The case reported three years ago was the 189th that had been reported to that date, the one I now report is the 192nd.

CASE REPORTS

Case 1.—A. C. W., white, male, widower, aged seventy-two years, presented himself for treatment June 25, 1930, complaining of left renal colic radiating to the suprapubic region and hematuria of a day's duration.

Family history was negative.

The patient had the usual diseases of childhood, pneumonia five years ago, and malaria six years ago.

In October, 1929, he had a severe attack of left renal colic with radiation of pain to the suprapubic region, which continued all day. He consulted a doctor, who found pus in the urine. About ten days later he had hematuria which lasted only one day. He has had no more pain, no frequency and no macroscopic blood in the urine since. He occasionally voided once at night.

Physical examination revealed a large, well developed male, weight 210 pounds. All teeth were removed some years ago. Examination was negative except for the genito-urinary tract. Blood pressure was 128/68. Blood count gave red blood cells, 5,000,000; leukocytes, 8,800; polys, 74 per cent; hemoglobin, 90 per cent. Neither kidney was palpable or tender and first percussion elicited no pain. X-ray examination of the chest and long bones was negative for metastases.

Cystoscopy was performed July 5, 1930, a Brown-Buerger cystoscope being used. The bladder and ureteral orifices appeared normal, no blood from either orifice. A No. 6 X-ray catheter passed easily to each pelvis; moderate flow of clear urine from each. Phenolsul-

phonephthalein appeared in two and one-half minutes from the right kidney and 20 per cent in fifteen minutes. From the left it appeared in three and one-half minutes and 11 per cent in fifteen minutes. X-ray film and left pyelogram were made, 15 c.c. Cunningham solution being injected into the left kidney pelvis, 4 c.c. into the right. This was withdrawn after the film was made and 3 c.c. neosilvol, 15 per cent, injected into each.

X-ray examination showed no evidence of stones in kidneys, ureters or bladder. The right kidney showed no evidence of pathology. There

Fig. 1. Section of specimen—papillary adeno-carcinoma of the renal pelvis.

was a marked filling defect in the left kidney pelvis, with absence of the lower calix, and a decided bulge in the convex border of the left kidney. These findings were corroborated by the injection of urosel-ectan intravenously.

Specimen from the left kidney showed a few red blood cells, a few pus cells, and many epithelia. That from the right kidney contained an occasional red blood cell, an occasional pus cell, and many epithelia. P. S. P., right kidney was 19 per cent; left, 11 per cent.

Diagnosis was papillary adeno-carcinoma of the left renal pelvis. A left nephrectomy was performed July 4, 1930, the usual oblique kidney incision being made high along the lower border of the twelfth rib. The kidney was easily freed. It had a long pedicle. The ureter was freed, ligated and severed, and was apparently uninvolved. The kidney appeared normal. The pedicle was transfixed and ligated with

Fig. 2. Photomicrograph of specimen shown in Figure 1. × 140.

No. 2 chromic catgut, two ligatures being applied and vessels also ligated separately. Cigarette drain to the pedicle was used. The wound was closed to drain, with No. 2 chromic catgut for muscles and

fascia, silkworm gut for skin, one through the drain. The wound was healed in two weeks and the patient made an uneventful recovery.

Pathological Report.—Gross: The left kidney appeared about normal in size. It measured 12 × 7 × 3.5 cms., and weighed 155 grams. The pelvis was slightly dilated. There were no adhesions over the capsule, which stripped easily. There was apparently some distortion of the convex border of the kidney near the lower pole. On section a soft papillary growth was found to arise from the mucous membrane of the pelvis, which showed definite invasion of the parenchyma in the lower pole of the kidney. The growth was about 3 cms. in diameter and was covered over with some dark coagulum. The pelvis was moderately dilated. The parenchyma was normal in appearance.

Microscopic examination showed the section to be made up of long villous strands of connective tissue covered by tall epithelial cells and inclosing narrow sections of tubules into which the papillomatous processes projected. The nuclei of the epithelium were rather small and granular.

Pathological diagnosis was papillary adeno-carcinoma.

Case 2.—Report of progress of case of papillary adeno-carcinoma reported in 1928, M. C. J.

In this case the left kidney was also the affected one. Both the left kidney and left ureter were removed at one sitting on November 28, 1927. This patient remained well and free of any urinary symptoms until August 21, 1930, when he returned, complaining of slight pain in the lower left quadrant. Urinalysis was negative except for a few pus and blood cells.

Cystoscopy showed a small papilloma about the size of the end of the little finger behind and to the right of the right ureteral orifice. Both ureter openings were normal. With cystoscopic forceps three pieces were removed for examination and the papilloma fulgurated. The pathological report was non-malignant.

Cystoscopy was performed October 1, 1930. The papilloma was about the same size and was fulgurated again. On November 6, 1930, the papilloma was still present, but was smaller and more shaggy in appearance, with some calcareous deposits on it. Fulguration was again applied and the patient was given a course of deep X-ray treatments by Dr. Bethea at the Baptist Hospital. On February 6, 1931. he returned and on cystoscopy the bladder was free of any evidence of papilloma, and he was relieved of all pain. His urinalysis was negative. He has remained free of symptoms since that time.

DISCUSSION

Dr. Henry G. Bugbee (New York City): The literature of the last ten years is filled with reports of a great variety of kidney tumors and it seems to me that the reason for this great variety of tumors is that a diagnosis has been made of renal tumor much more frequently than it was previously, owing to the greatly improved diagnostic methods.

To my mind the important element is to make a diagnosis of tumor of the kidney and, when it has been made, to differentiate, if possible, between a tumor of the parenchyma of the kidney and a tumor of the pelvis of the kidney. When a diagnosis of tumor of the kidney has been made, a nephrectomy is indicated. If a tumor of the pelvis of the kidney has been differentiated, that calls for a nephrectomy and ureterectomy.

I speak of this point because Dr. Kretschmer mentioned the possibility of removing the tumor of the kidney in his case. Had he opened the kidney first and inspected it, I think that would have been a very risky procedure to follow in tumor of the kidney, because so many of these tumors show on microscopic section a variety of pathology. One section of the tumor may show only benign tissue and another section of the same tumor may show malignant tissue, and I doubt if it would be possible to make a practice of making a diagnosis on inspection, if a kidney were opened, as to whether the tumor was benign or malignant. I believe that in every case of tumor of the kidney, the kidney should be removed, if the other kidney is a healthy one.

Dr. Hugh Cabot (Rochester, Minn.): I want to touch upon a point that was suggested by Dr. Bugbee and that is the principle involved in the treatment of these tumors of the renal pelvis. I think Dr. Livermore has had extraordinarily good luck in not getting into trouble on account of not removing the ureter. My experience has unfortunately been precisely the reverse, namely, that on the only two occasions in which I have failed to remove the ureter, the patient has died of that failure. Of course, with a patient as old as one of his patients, one is justified in doing

a partial operation. I think it is very important, however, that we should lay down the rule that with this variety of tumor not only the ureter but the bladder in the neighborhood of the ureter should be removed. In one of my cases it was believed that the ureter had been sufficiently removed down to the bladder wall. Failure to remove that portion of the bladder wall, however, killed the patient. I therefore think we should be quite firm in enunciating the doctrine that the ureter and the adjacent portions of the bladder ought to be removed; that if we cannot do it, then we have been unable to do the operation which is really indicated.

Dr. Edward L. Keyes (New York City): While subscribing heartily to my friend's last remarks, that it is a grand scheme to remove the ureter, there are, of course, cases in which, either because of our own timidity or because of the patient's evil state, we hesitate to remove the whole ureter. It is something of a job and a strain on the patient. I have already reported one case, about five years ago, of a patient from whom I first removed the kidney and the ureter down to the bladder. She was in her late seventies and very frail. On making a cystoscopic examination later, I found that she had a recurrence in the bladder. She came back to this country from France and submitted to the application of radium to the wall of the bladder, where this tumor projected from the lower end of the ureter. After I had given radium once or twice by cystoscope without controlling the tumor, I opened the bladder and implanted a good deal of radium thereabouts and was so fortunate in that instance as to control the tumor. She has remained well about five years now.

I would like to add also to what I think was a very interesting remark by Dr. Livermore, concerning the bladder tumor occurring on the other side of the bladder from the side on which the ureter and the kidney pelvis were involved. I, too, have had such a case.

Dr. William F. Braasch (Rochester, Minn.): There is one feature of papillary tumors of the renal pelvis which I think has not been sufficiently emphasized and that is the great mortality attending this type of tumor. In fact, I do not recall one instance of pelvic tumor with metastasis in the ureter or bladder where the patient has lived more than three years after operation. I think

that the prognosis is exceedingly grave as soon as it goes beyond that stage, and I know the metastases are more general than by mere passage into the ureter. Where it is confined to the kidney, of course, the prognosis is much better, but any metastasis outside is an indication of very grave prognosis.

DR. ROGER C. GRAVES (Boston): I should like to ask Dr. MacKenzie whether he differentiates his lesion from the varices of the renal papillæ, so-called papillitis?

DR. DAVID W. MACKENZIE (Montreal): That has been differentiated in the paper, Dr. Graves, with a good deal of pathology. The first case, in which you saw the upper pole, was shown some years ago.

DR. GEORGE R. LIVERMORE (Memphis): In answer to Dr. Cabot, I agree absolutely with his idea that the ureter should be removed with a section of the bladder. In the first case that was done and yet the growth has returned, and, as I stated, on the opposite side of the bladder. No specimen of the growth that I have showed taken out cystoscopically showed any malignancy. Yet it would not respond to fulguration, but after deep X-ray had been applied it did respond to fulguration and has disappeared entirely and the patient has remained well since that time.

RETROPERITONEAL FIBROLEIOMYOMA

HARRY CULVER, M.D., and WILLIAM J. BAKER, M.D.
From the Urological Service of St. Luke's Hospital, Chicago, Illinois

CASE REPORT

A man, fifty-one years of age, was admitted to the medical service of St. Luke's Hospital with an examination room diagnosis of splenomegaly. He presented himself for examination because of a mass in the left upper quadrant of his abdomen. He had discovered this mass himself, two weeks before admission to the hospital, while pressing on his abdomen to relieve distress after eating. This abdominal distress had been present for three months, and was gradually increasing in severity. It was intermittent in character and did not occur regularly after every meal; sometimes it lasted but a few minutes, at other times a half hour or more. This distress had some influence on the character and amount of food taken, which undoubtedly had much to do with his loss of 20 pounds of weight during the three months period of his symptoms. For the last year there had been some urinary difficulty, with both day and night frequency. This was apparently not associated or influenced by the symptoms more recently acquired.

Examination revealed a well nourished man not acutely ill, with no abnormal physical findings excepting the presence of a readily movable mass in the left upper quadrant extending downward as far as the crest of the ilium. The consistency of the mass was firm but not hard, regular in its consistency throughout, having a definitely smooth surface and not painful on rather vigorous palpation. It corresponded with the usual palpatory findings of a large solitary cyst of the kidney excepting for its irregularity of contour and feel of a solid rather than a cystic mass.

Laboratory study showed 5,510,000 erythrocytes, 90 per cent hemoglobin, and 8,150 leukocytes, while a routine urine examination revealed a trace of albumin, no sugar, a few granular casts and a few pus cells. There was no apparent infection of the urinary tract. The blood contained 34 mg. of non-protein nitrogen per 100 c.c. of blood.

Cystoscopy and complete urologic study demonstrated the prostate to be small and apparently normal and the urethra patent to No. 24 F. instruments. There was residual urine of less than 1 ounce. Slight elevation of the trigone and post-cervical lip was noted in an otherwise normal appearing bladder. Both ureters were catheterized readily and urine collected for study. Differential function determined by the intravenous injection of phenolsulphonephthalein was normal in

concentration from both kidneys, but the appearance time of the dye was somewhat delayed on the right side (11 minutes) while that of the left side was normal (4.5 minutes).

Urine collected from both kidneys was sterile and otherwise normal excepting for the presence of an occasional granular cast from each kidney.

Roentgenograms showed the right kidney in normal position and of normal size, while the left was apparently in contact with a dense rounded shadow extending downward below the iliac crest (Fig. 1).

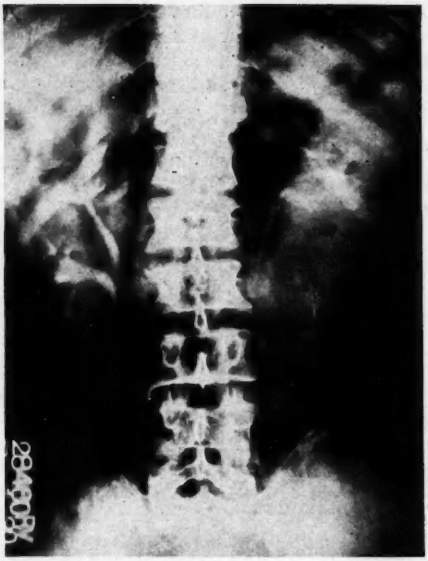

Fig. 1. Intravenous urogram visualizing the right pelvis, and the left less distinctly. Distinct mass evident in contact with the lower pole of left kidney.

A left retrograde pyelogram was made (Fig. 2) which demonstrated the left kidney pelvis lower than its normal position with slight rotation on its long axis, with a deformity of the lower calices read as a pressure deformity.

Uroselectan, given intravenously, visualized the right renal pelvis satisfactorily, but very little of the contrast medium was noted on the left side on any of the interval plates.

On these findings the diagnosis of neoplasm of the lower pole of the left kidney was made.

Operation was performed October 15, 1930. Through an oblique left lumbar incision a firm, smooth mass was readily freed from its soft fibrous attachments to the peritoneum and soft tissues with no bleeding that required ligation for control. The mass was intimately adherent to the lower pole of the kidney over an area one inch long and one-fourth inch wide. Not knowing the character of the attachment or the nature of the mass, but finding the kidney normal in all

Fig. 2. Retrograde pyelogram of the left kidney revealing long axis rotation, filling defect of the lower calices and inward displacement of the ureter.

respects grossly it was deemed advisable to remove the tumor together with a wedge shaped portion of the kidney parenchyma, which was readily done and the kidney closed, using a pad of fat sutured to cover the defect. The wound was closed without drainage and healed by primary union.

The patient made a rapid recovery and has been free from all symptoms since leaving the hospital.

Tissue study by Edwin F. Hirsch: "This encapsulated mass of firm white tissue weighs 1,426 grams after some of the contained fluids have escaped. It has a thin fibrous capsule to which are attached several tags of lobulated fat that make no large volume. The mass is roughly wedge shaped, 19 cm. long, 16 by 8.5 cm. at the base and 7 by 6 cm. at the apex. On surfaces made by cutting are lobules and bands of firm white tissue with fibrillar markings and

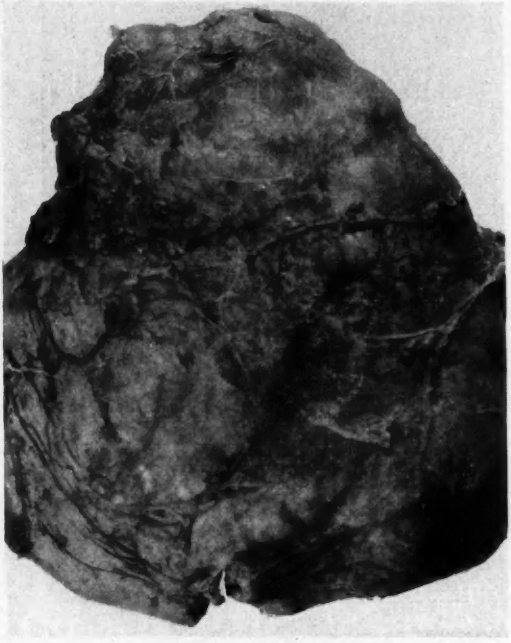

Fig. 3. Tumor weighing 1,426 grams as it appeared upon removal.

markedly edematous. These lobules are as much as 2 cm. in diameter. Midway between the apex and base on one side is a small mass of kidney tissue 1.2 by 1.2 by 0.8 cm. It seems to be tissue directly continuous with the capsule.

"*Histology.*—The hematoxylin and eosin stained preparations have broad interlacing bands and bundles of well-differentiated spindle-shaped cells that resemble very much smooth muscle cells, and are held together by a less compact fibrous tissue. Sections stained with phosphotungstic acid-hematoxylin have a large amount of purple myoglia tissue. There are broad interlacing bands with only a little of the collagen supporting stroma which is distributed chiefly about the vessels. The cells are long, spindle-shaped, the nuclei elongated, sinuous, vesicular and with fine chromatin granules. In the edematous portions there are small bundles and in those cut in the longitudinal plane a

Fig. 4. Tumor sectioned revealing the tissue to be in lobules.

careful search for cross striations was made. In none of the places examined did these structures appear in the fibrils. There is necrosis of the tissue in the markedly edematous portions."

Benign retroperitoneal tumors are not common, although the literature contains more than 200 cases, most of which are lipomatous in nature, and therefore not pertinent to this report. Parsons[3] in 1928, in recording a case of retroperitoneal fibromyoma cites 12

authentic instances of this disease. Gastric symptoms, loss of weight and the presence of a tumor mass were the symptoms usually encountered, although the tumor in her case was found during laparotomy for another condition. A case is cited in a female patient by Fiori[1] of true retroperitoneal fibromyoma associated with similar tumors of the uterus. This at once suggests the possibility of metastases, but since none of the organs which usually receive metastases from the uterus were involved, it would seem reasonable to conclude that they were independent tumors.

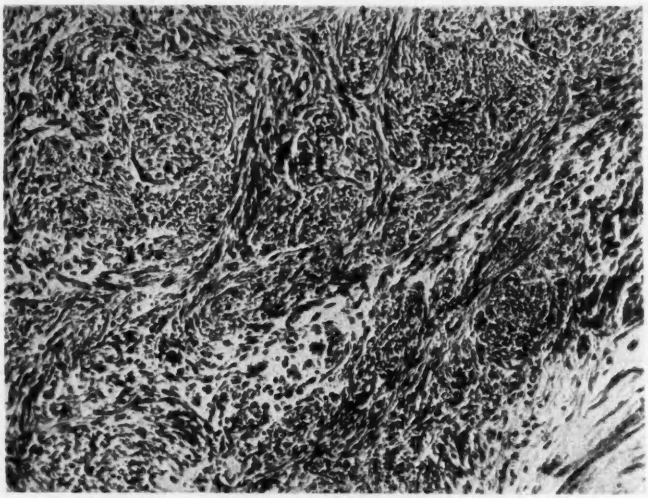

Fig. 5. Photomicrograph (× 120) demonstrating smooth muscle tissue together with a smaller amount of fibrous tissue.

The patient under discussion being a male with no other apparent similar lesion elsewhere in the body, the probability of this tumor being metastatic is indeed remote.

The origin of retroperitoneal tumors obviously is speculative. All types of tissue in the retroperitoneal space may at any time develop abnormal growth, but unstriped muscle, under normal conditions, is not present in this space, which suggests the conclusion that they are embryonal in nature and result from developmental

defects producing tissue rests which eventually may take on abnormal growth. Hausmann and Budd[2] have recently covered this subject and have directed attention to the fact that the histology of these tumors is variable; reported cases have contained glomeruli, renal tubules, rete structures, muscle, uterine mucosa, and chorion epithelium. They conclude that these tumors arise from remnants of the embryonal urogenital apparatus.

The case herein reported is of special importance since the tumor was intimately adherent to the lower pole of the kidney by fibrous tissue. We have considered this union to be secondarily acquired, but have not entirely dismissed the possibility of its being of renal origin.

The differential diagnosis of these tumors is very difficult; the process of exclusion seems to be the best method of arriving at the correct diagnosis, which is so rarely made. The important determination of the retroperitoneal position of the mass should be accomplished in a high percentage of cases by the exclusion of organs anatomically related to the growth.

A case of retroperitoneal fibroleiomyoma attached to the left kidney is here recorded because of its relative rarity and multiple mistakes in diagnosis. Examining room diagnosis of splenomegaly made on superficial study was changed to renal neoplasm after careful observation and complete study both by the internists and urologists. The correct diagnosis was never even considered in the differential diagnosis and was made only by surgical removal and subsequent histologic study.

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DISCUSSION

DR. A. RANDALL (Philadelphia): I might add another case to this picture showing the pseudo-mistake into which I fell. I was asked to see a private patient and study him urologically for a general surgeon. The man, on physical examination, had a typical floating kidney. Being of a very lean build, it was no trouble at all to feel and outline this kidney mass in the right loin and reduce it down into the iliac fossa or move it back up into its normal position. Differential study showed a normal kidney function on that side and a pyelographic study taken in various positions likewise showed a normal kidney. I drew the conclusion that the man probably had some tumor of his sigmoid, ruled out the urinary tract, and referred the patient back to his surgeon. The surgeon explored the abdomen and found it normal. He still felt the mass, found it was retroperitoneal, made a retroperitoneal incision and removed a fibroleiomyoma whose most unique characteristic was that after extirpation it had exactly the shape of the kidney. There was a smaller secondary similar growth found back of the primary one.

ANGIONEUROTIC HEMATURIA OF FIFTEEN YEARS' DURATION

FRANCIS R. HAGNER, M.D.
Washington, D. C.

The case of so-called angioneurotic or symptomless hematuria here reported was of fifteen years' duration; an autopsy was obtained, and the history, except for the terminal streptococcus infection, is almost identical with the cases which I have had under observation for many years.

In nearly all of the cases which I have been able to follow the patients have eventually died of arterio-renal disease, and I believe that if these cases are observed to the end-result we will be forced to the conclusion that the symptomless hematuria in a large proportion of cases is the manifestation of early glomerular change in the kidney, and that the end-result will be death from arterio-renal disease.

A white man, fifty-five years of age, was examined by Dr. Fuller on July 7, 1930. He consulted us for blood in the urine. This condition has existed for fifteen years. At times his urine would clear slightly but it was very rarely free of macroscopic blood. He presented no other subjective symptoms, except at times some digestive disturbance. At this time his blood chemistry was normal.

His right ureter was catheterized and urine filled with blood was collected. There was no pus in the urine and cultures were sterile. A pyelogram was made and the pelvis was normal in appearance. Two days later the left ureter was catheterized and blood was noted secreting from this kidney. The urine, on examination, was identical with that of the right side.

Uroselectan, 15 per cent, was injected and this also demonstrated a normal pelvis. At this time his blood pressure was 130.

A diagnosis of arterio-renal disease was made. The bleeding continued after the examination.

The following is the history after admission to the hospital on November 29, 1930, about four and one-half months after we first saw the patient:

About two months after ureteral catheterization the patient had fever of several days' duration. He had been refused life insurance on several occasions because of high blood pressure.

He had Neisser's infection at twenty-two years of age. There was no history of lues or previous heart disease, and no rheumatic history other than an attack of "walking typhoid" so-called, at the age of twenty. At this time he was febrile and had pains in the legs for three or four weeks, but did not go to bed.

The patient was the father of one child, who is alive and well. His child is the mother of two healty children.. Neither the wife nor daughter had had miscarriages.

Positive findings were:

1. Numerous replacement dentures of poor quality and severe gingivitis and pyrorrheal infection.
2. Slight pharyngeal injection and tonsil hypertrophy.
3. Eye grounds showed grade 11 arteriosclerosis.
4. Marked arterio-pulsations in the neck, radial pulse full with quick fall. No pistol shots—apex in sixth interspace 5 cm. outside mid-clavicular line—right border dullness not made out. Submanubrium dullness increased in first and second interspace—heart sounds distant—rhythm regular. Soft distant systolic murmur at apex followed by musical diastolic. Diastolic murmur occupying all of diastole well heard at aortic area and transmitted to left border sternum. Blood pressure 130/75.
5. Lungs clear except for slightly prolonged expiratory murmur.
6. Spleen enlarged and palpable.
7. Varicosity of the superficial veins of the legs.

At the time of this examination the patient seemed to be quite well and was exhibiting no signs of septicemia or cardiac embarrassment. He had, however, been running a septic temperature ever since admission. Examination of the blood ruled out the purpuras and blood dyscrasias. There was a moderate anemia and the leukocytes were 10,000. Wassermann reaction was negative.

The first positive blood culture was obtained eight days after admission and a non-hemolytic streptococcus was reported. About ten days after admission the patient began showing first signs of congestive failure and from then on until his death on January 15, 1931, went rapidly down hill. Temperature remained elevated and of the septic type, running between 97 and 102. The leukocytes varied from 7,000 to 13,000. Blood culture repeated four to five times yielded non-hemolytic streptococcus in each case. The urine showed occult blood at nearly all times though at some times it was macroscopically clear. The spleen became progressively larger and was palpated with ease. Seventeen days after admission petechial spots were first noted on both ankles. From then on new showers occurred about every other day, the whole body being finally peppered with them; many were ecchymotic in size; the conjunctivæ and retinæ were not affected. Ten days before death weakness and numbness of the left arm was complained of and a spinal puncture was done. The fluid showed twenty-eight

cells per cubic millimeter. Wassermann reaction and colloidal gold were negative. This paralysis persisted.

The patient became progressively more toxic and there developed a pitting edema of the ankles, legs, thighs and buttocks—dyspnea became severe and the patient grew orthopneic. The aortic diastolic murmur at this time was very pronounced. The lung fields remained relatively clear except for some congestive râles at the bases.

The patient lapsed into a comatose state and died on January 15, 1931, forty-eight days after admission, apparently as a result of the toxemia.

Anatomical diagnosis was (1) Vegetative endocarditis; (2) infarcts of spleen; (3) chronic glomerular nephritis with multiple embolization.

Autopsy examination showed the kidneys were definitely enlarged. The capsule stripped readily, leaving a smooth grayish surface. On gross section there was little of the pyramidal structure remaining, and these areas were intensely congested. The cortex was relatively definitely increased, largely as the result of fibrosis as indicated by the gray striations.

Microscopic examination of the tissue removed at autopsy revealed numerous extensive areas in the kidneys in which there was marked fibrosis, the tubules being widely separated and frequently considerably compressed. In other areas there was marked congestion in which the vessels were distended, and the tubules frequently contained red blood cells in large numbers. There were also foci of leukocytic infiltration similar to those described in the liver. The glomeruli in the greater part of the sections were well preserved. In certain areas, however, they appeared to have been replaced by fibrous tissue, and a number of them were distended and congested.

NEPHROSTOMY: INDICATIONS AND TECHNIC

HUGH CABOT, M.D., and WILBUR W. HOLLAND, M.D.,

From the Division of Surgery, The Mayo Clinic and The Mayo Foundation, Rochester, Minnesota

The operation of nephrostomy, more or less formally done, has been in common use for more than forty years. During the earlier period it was usually applied to much overdistended kidneys and was usually an emergency measure carried out without the possibility of any very complete knowledge of the condition of the upper part of the urinary tract. On the other hand, as early as 1898, there was a pretty full discussion of this subject by Guyon and Albarran. They drew attention to the apparently great ability of renal tissue to resist infection if it was not already present, and to shake off infection if it had occurred, provided, always, satisfactory drainage of the kidney by nephrostomy was achieved. They noted the ability of the kidney again to take up its function "to an extent more or less complete according to the damage which has been produced. If the obstruction has been of short duration, function is but little disturbed. If the retention has been of long duration, it will have produced a more or less irreparable damage to the parenchyma and renal function is, to that extent, permanently damaged."

Much of the literature concerns itself with questions of technic which have, of course, been much modified during the period elapsed. Pakowski, in 1913, presented an extensive discussion of this subject, including a considerable investigation of the return of renal function and of the ability of the kidney to resist or rid itself of infection. He stated his agreement with the principles laid down by Albarran in 1898.

There thus appear to be two very important principles involved: one, the ability of the kidney to deal with infection, and the other the effect on renal function. Writers, particularly of the French school, stress the ability of the kidney to deal with infection. On the other hand, other writers, particularly Joly, regard infection as a very serious matter, and Joly points out that in his experience

infection of the kidney with urea-splitting organisms, particularly staphylococci and the Proteus, give a very unfavorable prognosis. He expressed the opinion that infection of one kidney with these organisms is very likely to be transmitted to the other kidney through the blood stream, and said: "Once a bilateral infection is firmly established, the outlook is very bad, and the patient usually dies of uremia. The process is necessarily slow, but it is none the less sure." This observation leads him to advise nephrectomy when such an infection has occurred in order to avoid involvement of the other side. These two sets of views are so much at variance that it seems desirable to attempt a collection of evidence which will determine which, if either, is to be regarded as basic.

The early observers were impressed by the rapid return of function among patients with high-grade renal obstruction treated by this method. On the other hand, Hinman, in 1922 and subsequently, did some very important work on the problem of repair after obstruction and laid down the principles of what he termed renal counterbalance. These observations are obviously of very fundamental importance and, if we accept fully his thesis that, in the presence of hypertrophy of the kidney on the other side, an obstructed kidney is likely to go on to complete atrophy, many of the situations likely to appear favorable for nephrostomy should, in fact, be treated by nephrectomy. It is of course difficult to apply his doctrine to the cases which we see clinically because the situation is rarely if ever quite so clean-cut as in experimental work. That his conclusions may not be quite so far-reaching is suggested by the work of Joelson, Beck, and Moritz, published in 1929, in which they went over the ground covered by Hinman and were unable to agree with his conclusions. They say quite dogmatically: "Our experiments did not demonstrate any renal atrophy of disuse and in fact strongly suggest that such atrophy does not occur. In view of the experimental data presented the theory of renal counterbalance need not be seriously considered in deciding the surgical treatment for certain renal lesions." This evidence of disagreement between capable experimenters may be taken to authorize us at least to reserve our judgment as to the extent to which atrophy will occur where the injured kidney is working in competition with an hypertrophied kidney on the other side. As already pointed out the clinical situations are by no means as clean-cut as those pro-

duced by experimental surgery, and consequently the field of application of Hinman's doctrine may be considerably limited. We think we are at least authorized to regard the doctrine as a not very important factor to be considered in the clinical application of nephrostomy, and we should be on sound ground by using the operation perhaps more widely than has been the habit in the past, partly at least for the purpose of establishing clinical results and forming the basis for an opinion of the weight to be given by the quite opposite opinions held by such observers as Pakowski and Joly.

INDICATIONS

In general terms the indications for nephrostomy are the presence of obstruction which cannot be satisfactorily remedied by some other method. There is also perhaps a satisfactory indication in preventing progressive injury to kidneys in which there is incomplete obstruction which favors the continuance of infection, as, for instance, in patients with bilateral calculous disease with steadily waning renal function. Another group with somewhat similar implications are those with inflammatory lesions perhaps primary in the bladder, but which have invaded the upper part of the urinary tract and in which drainage of the kidney is thus seriously and more or less permanently interfered with. Here also may be considered that group of patients with as yet unexplained lesions apparently of the nerve supply resulting in abnormal vesical function with dilated ureters and renal pelves. In both of these groups of cases renal function is apparently being slowly but steadily destroyed and will go on to the stage of renal insufficiency unless its progress is halted. If it is true that nephrostomy can be done without danger of progressive renal infection and if it is true that by nephrostomy renal function can be improved or maintained over a period of years, there develops here a relatively clear indication. In general one may consider the application of nephrostomy to the following conditions:

1. Acute obstruction either of both ureters or of the remaining ureter as in calculous anuria or malignant disease constricting the lower end of the ureter.

2. Hydronephrosis or infected hydronephrosis in which the cause of the obstruction may be removable, but in which drainage of the kidney as a temporary measure is indicated to improve func-

tion. In this group of cases there may develop some in which the nephrostomy may have to be permanent.

3. Renal calculi. There are here at least two distinct groups for which nephrostomy temporary or permanent may be desirable. In one group are cases in which there is considerable destruction from high grade blocking of the outlet but in which the removal of stone will substantially relieve the difficulty. For some of these cases at least temporary nephrostomy may be desirable for the purpose of permitting readjustment between the pelvis and the ureter, to allow rapid recovery of renal function, and, at least possibly, to aid in the quieting of renal infection. Another group includes cases of bilateral stone formation of the type which is not now regarded as satisfactory for treatment by removal of the stones. There is a considerable number of these in which massive stone formation occurs on both sides with relatively few symptoms but after a time leads to progressive failure of renal function which will prove fatal if it cannot be relieved. It will be remembered that Watson, in 1910, suggested nephrostomy for relief of some of these patients, and on at least one patient he performed bilateral nephrostomy, which maintained satisfactory renal function for more than ten years. In this connection we would suggest that there appears to us to be some possibility that nephrostomy maintained for a considerable period may have a very definite influence on the formation of stone, although we do not think that the evidence on this point will as yet warrant any conclusion. A recent publication by Boyd calls attention to this point and at least in one of Watson's cases stones appeared to develop with much less rapidity after nephrostomy. We think, therefore, that in this group it may appear that there is more than one ground on which nephrostomy permanent or semi-permanent may be advised.

4. Nephrostomy must, perhaps at least for the present, be retained as an occasional method of diverting the urinary stream in cases of carcinoma of the bladder thought suitable for total cystectomy.

5. We would here include that obscure group of cases in which the failure of the muscular apparatus of pelvis, ureters, and bladder satisfactorily to evacuate the urine leads to progressive atrophy of the kidneys. This group will doubtless become increasingly amenable to treatment by other methods, but we are at present faced with

a certain number of these patients in whom renal insufficiency threatens, relief cannot be assured by other methods and nephrostomy may be relied upon to check further damage and perhaps allow for some measure of regeneration.

6. We would here include a group of cases of renal infection without high-grade obstruction in which the nephrostomy is done as a method of avoiding recurrent renal infection and allowing some amount of renal recovery.

TEMPORARY OR PERMANENT NEPHROSTOMY

The decision as to whether nephrostomy should be temporary or permanent will not ordinarily be difficult. Permanent nephrostomy should probably be reserved for those cases in which the condition for which nephrostomy is done cannot be remedied or at least cannot be remedied to a permanently satisfactory extent. In a few cases nephrostomy which has been maintained as a temporary measure will have to be made permanent since methods to relieve the obstruction have failed. The duration of temporary nephrostomy will of course vary wholly with the conditions for which it is done. Thus the nephrostomy done for calculous anuria must be maintained until the calculus causing the obstruction has been removed and until recovery of renal function appears to be satisfactory. Such drainage might continue for from three to several weeks. In the same way the nephrostomy which is done in connection with plastic operations on the renal pelvis will be continued until it is judged that the healing of the operative wound has become satisfactory. Finally, nephrostomy which is done in connection with the removal of renal calculi will vary in its duration according to the condition of the kidney and according to the development of our belief that nephrostomy with its attendant possibilities of altering the physical conditions within the kidney may be used to affect the rapidity or probability of recurrence of stone.

NEPHROSTOMY VERSUS PYELOSTOMY

It will be proper at this time to indicate our opinion of the relative value of nephrostomy and pyelostomy as a method of temporary drainage. In the presence of a distended renal pelvis and particularly when that structure has been opened for the removal of calculi, drainage of the renal pelvis has been regarded as the ob-

vious and simple method. It is, we believe, open to certain objections which have in our experience considerably limited its use. It is much more difficult to retain the drainage tube accurately in the renal pelvis if drainage is to be continued for more than one or at most two weeks. The accurate replacement of the tube is difficult and not rarely impossible and it commonly occurs that a tube slips out of the pelvis before satisfactory drainage has been accomplished, cannot be accurately replaced, and drainage has to be abandoned. It has also been common in our experience that although the drainage tube may remain in satisfactory position for a matter of ten days or two weeks, when it is desired to remove it and replace it by another tube, such replacement has been inaccurate and the result unsatisfactory. The operation has been regarded as desirable because it did not injure renal tissue, did not expose to the same danger of fulminating renal infection as might occur in an infected kidney, and was in all respects a much less serious procedure. We hope to be able to show that nephrostomy may be done by methods which will make it a quite trivial procedure and much less exposed to the above mentioned objections than when carried out by methods more generally in use. On the whole, we incline to the opinion that pyelostomy has a much more limited scope than nephrostomy and one which will tend to become even more limited in the future.

SUMMARY OF CASES OF NEPHROSTOMY

During the last year we have performed nephrostomy in thirty-three cases and these may be used to illustrate our suggestions in regard to its application.

Nephrolithiasis.—In this group there have been fourteen cases, of which seven were instances of bilateral stone. There were six instances of unilateral stone with seriously injured kidneys in which the method was employed in the attempt to preserve the kidney. One was a case of a single remaining kidney, the other having been previously removed elsewhere for calculous disease. The patient had had two recent attacks of calculous anuria.

In all of the cases of bilateral nephrolithiasis the urine was seriously infected. Two patients had been previously operated on with rapid reformation of the stone; the renal function of both, as measured by the return of phenolsulphonphthalein, was markedly below

normal. The operation was used in all these cases as a method of attempting to improve renal function and, by local treatment of the renal pelvis, to alter perhaps the rapidity of recurrence. In all cases the immediate results were satisfactory. We cannot, of course, form any judgment as to the late results. In some cases the condition of the kidney at operation seemed very bad, yet we hesitated to do nephrectomy on account of the condition of the other kidney. It was surprising to note that in three cases, kidneys which at operation apparently contained nothing but stones and pus, within twenty-four hours were putting out a normal quantity of fairly satisfactory urine, both from the point of view of appearance and the point of view of function. At least as a temporary measure nephrostomy in these cases seemed well worth while.

In three of the six unilateral cases stones were firmly impacted in the upper part of the ureter with no clear evidence of renal function on that side. At operation, however, the amount of remaining renal substance seemed too great to sacrifice and nephrostomy appeared to show that this judgment had been sound. In the other three cases the stones lay in pelvis or kidney, but again the amount of remaining renal tissue seemed too great to sacrifice although the function was very poor before operation. This small experience suggests to us that this method may permit the retention of a certain number of kidneys which have heretofore commonly been removed on account of the evidence of injured function. In the present state of our knowledge it is doubtful whether we have any test of the function of a stone-containing kidney on which we can rely as an indication of the permanent function of that kidney.

The remaining case in this group was that of a woman whose left kidney had been removed elsewhere three years ago on account of stone. During the last year she had had two attacks of anuria. Before operation the total renal function was below 20 per cent, although there was no elevation of nitrogen in the blood. Operation revealed a much dilated and apparently considerably injured kidney, but after nephrostomy this kidney drained freely, its function improved, and four months later the output of phenolsulphonphthalein was 40 per cent. In this case the nephrostomy was made permanent.

Hydronephrosis.—We include here five cases of hydronephrosis apparently due to congenital anomalies in which plastic operations

were done on the renal pelvis. In these cases temporary nephrostomy was done in order to allow time for accurate healing of the wound of the pelvis. In all of these cases the tube was removed in between two and three weeks and the condition of the kidney at that time seemed satisfactory. This method has seemed to us preferable to draining through the pelvis in such cases and we believe that some method of drainage other than that which can be obtained through a ureteral catheter is desirable.

Lesions of the nerves.—The next group is composed of four cases of obscure neurologic lesions resulting in failure of the urinary musculature apparently throughout. In these cases nephrostomy was resorted to in the hope of stopping progressive renal injury. One was the case of a man, aged twenty-four years, whose difficulty apparently followed a gunshot wound of the abdomen. There was extensive pyonephrosis on both sides with dilatation of pelves and ureters. Bilateral simultaneous nephrostomy was done after serious renal insufficiency had developed and the concentration of nitrogen and creatinin in the blood was rising. The operation failed to stop the injury and death occurred two weeks after operation. Another case was that of a female child, aged three years, with congenital anomalies of the nerve supply and infectious purpura apparently due to bilateral infected hydronephrosis. Her condition was very bad and nephrostomy was done on the left side. It failed to influence the process. Another was a child, aged five year, with a similar lesion but less infection. Nephrostomy was done on the right side with drainage of a much damaged kidney with an enormous ureter. Very marked improvement in general condition took place and the patient was dismissed with the nephrostomy tube in place. The remaining patient of this group was a man, aged thirty-four years, who had had urinary symptoms suggesting extensive infection of the urinary tract for many years. Careful urologic study showed right hydronephrosis with great dilatation of the ureter, but with no clear evidence as to cause other than a congenital nerve lesion. On the left side there was complete duplication of ureter and pelvis with two stones in the lower segment, considerable dilatation of the ureters, but good function. Study four months later showed that the function of the right kidney had diminished to almost nothing and the ureter on this side could not be catheterized. In view of the situation on the left side

it seemed as if an attempt should be made to retain the right kidney if possible. Nephrostomy was done and a month later the phenolsulphonphthalein function from this kidney was 20 per cent while that on the left side was 25 per cent. This patient was advised to return for operation on the left side for the removal of stones.

Obstruction of lower ureter.—The next group consists of three cases of obstruction of the lower part of the ureter. One was a case of bilateral injury to the ureter at the time of an operation for carcinoma of the uterus. In this case bilateral simultaneous nephrostomy was done which gave satisfactory and adequate drainage. This patient was later reported to have died six months later, probably from malignant disease. Another patient was also the subject of malignant disease of the uterus under treatment with radium. The disease had obstructed the right ureter and destroyed the right kidney more than a year previously. While under treatment with radium here sudden anuria developed and examination showed impassable obstruction of the remaining ureter. Nephrostomy was done within twenty-four hours with a most satisfactory result. The third patient was a man, aged fifty-two years, whose right kidney had been removed for pyonephrosis in 1927. In 1928 he had a perineal operation for prostatic calculi, and in March, 1931, a cautery operation on the neck of the bladder through the urethra. The latter part of April oliguria began to develop and finally anuria, and catheterization of the left ureter was impossible on account of deforming scar. Nephrostomy was done with an excellent result. At the present time a varying amount of urine is passed from the bladder. The ureter is not entirely obstructed but seems unable to take up its full function. Nephrostomy in this case was done in order to give an opportunity to make any necessary attack on the ureter possible.

Renal infection.—The next group includes three cases of infection of the urinary tract with extensive renal injury. The first concerned a man, aged forty-five years, with a long history of a painful infection of the bladder with final contraction of the bladder and infection of the upper part of the urinary tract. All methods of treating the bladder were unsuccessful and he suffered from recurrent attacks of renal infection first on one side and then on the other. Cystostomy had been tried and had failed. His condition

seemed so bad that the chance of benefit by nephrostomy seemed worth taking. This was done on the right in February, revealing a battle-scarred kidney without dilatation but with much thickening of the pelvis and ureter. Following nephrostomy his condition improved very much. Two months later he had relapse of the infection in the left kidney. This, interestingly enough, entirely interrupted the function on that side and for nearly two weeks the right nephrostomy carried on total function. Then the infection on the left quieted and the function of that kidney returned with rapid subsidence of the urinary output on the nephrostomized kidney. It is our intention to operate on the left kidney in view of the apparently marked improvement of the condition of the right. This case throws interesting light on the behavior of a kidney during acute infection. Another case was of a somewhat similar type with prolonged infection of the urinary tract, extensive injury to the bladder and ureters with recurrent attacks of renal infection on both sides which had resulted in very grave injury so that there was marked elevation of blood urea and a phenolsulphonphthalein excretion of 20 per cent in two hours. Pyelogram of the kidneys showed moderate bilateral infected hydronephrosis. Bilateral nephrostomy was done in two stages and the patient left the hospital a month after the second operation with marked improvement of renal function and in good condition. The remaining case in this group was an obscure one with probable renal tuberculosis on one side and obstruction of the ureter on the opposite side. Nephrostomy was done as an emergency measure for threatened anuria with blood urea of 152 and creatinin of 4 mg. in each 100 c.c. Marked improvement occurred after operation and the patient went home with a satisfactorily draining nephrostomy. He died four months later, probably of tuberculosis. These cases are introduced simply to indicate a possible field for nephrostomy in certain cases of advanced renal infection.

Carcinoma of the bladder.—The remaining four cases were of patients with extensive carcinoma of the bladder producing ureteral obstruction. Nephrostomy was done as a temporary measure to prolong comfortable existence but without any expectation of prolonged benefit on account of the extensive involvement of the bladder. The results seemed to have justified the operation.

Mortality.—In this group the mortality should be credited to the operation in three cases. Two patients had extensive bilateral infected hydronephrosis apparently due to abnormality of the nerve supply. The condition of these was desperate and they died really of the disease and not of the operation. One of the patients had extensive carcinoma of the bladder in which nephrostomy was done as a late measure. Our experience in regard to mortality is similar to that of all other observers, namely, that the operation itself is relatively safe but as it is frequently done for serious or desperate conditions it will be associated with the mortality properly to be expected in these situations.

Bleeding.—Bleeding did not occur following operation.

Infection.—We have had no instance of fulminating renal infection although this will doubtless occur in an occasional case in which any operation is done involving the renal parenchyma in the presence of existing infection. The effect of the operation on preexisting infection has during this brief period been satisfactory. There has regularly been prompt improvement of infection although it is, of course, as yet too early to express any opinion as to the ultimate effect.

Calculus.—We feel particularly interested in the patients with bilateral extensive calculous disease since it seems possible that prolonged drainage of the kidney by this method may preserve waning renal function and may influence the rapidity and extent of stone formation. On this point it is highly desirable that prolonged observation should be made.

TECHNIC

In the earlier days the operation consisted of a considerable nephrotomy along the convex border with the division of much tissue to enable the drainage tube to be accurately placed in the pelvis. This method has been practically wholly abandoned and has been replaced first by the method of Marion which introduced a dilator through the cortex of the kidney through which the tube was passed. Later was developed the method of opening the renal pelvis and passing a curved instrument out through the cortex at the desired point by means of which the drainage tube was drawn down into the pelvis and placed accurately in position. Papin, in 1927, advised the method of Marion for temporary nephrostomy

and the method of introducing an instrument into the renal pelvis for permanent nephrostomy. He at that time advised the use of a winged catheter, which was important in overcoming the very considerable danger that the tube would become displaced, work gradually out into the substance of the kidney, and finally fail to drain the kidney at all. One of the common and annoying complications of nephrostomy is this displacement of the tube. There is no structure of the kidney to which a tube can be safely and satisfactorily attached, but the use of a winged catheter seems to overcome this objection and maintain the tube in accurate position until such time as the drainage tract has become satisfactorily established.

The technic which we are suggesting is put forward as an improvement on this latter method. We have encountered a large number, and perhaps a fair proportion of the cases, in which the mobilization of the kidney sufficient to allow a curved instrument to be readily introduced into the pelvis and passed out through the desired point on the cortex is either impossible on account of the fixity of the kidney or involves an amount of preparatory dissection which unnecessarily prolongs and complicates the operation. In not a few of these cases, particularly those in which a bilateral simultaneous nephrostomy is indicated, the element of time is of importance and it has seemed to us that a method which could be employed without extensive mobilization of the kidney was desirable. There is also a certain number of these cases in which there is no dilatation of the renal pelvis, in which it may, in fact, be entirely intrarenal and in which the introduction of an instrument as illustrated by Papin has in our hands been difficult.

The method which we suggest is as follows: The kidney having been exposed and mobilized to an extent to give access to the upper part of the ureter and the renal pelvis, a small opening is made in the pelvis, although in the case of the intrarenal pelvis it may actually be made in the ureter. A uterine sound with a slightly bulbous tip bent in "U" shape is introduced into this opening and passed out through the cortex at the point selected. This point should, we think, be placed so as to drain the lower calix as the most efficient method of draining the kidney, but it should also be placed in relation to the convex border of the kidney in such a way that the drainage tube will lead straight from the wound and not

be exposed to angulation as the kidney falls back into its normal position. This point can be readily ascertained by seeing where the kidney will most comfortably lie, and the sound, which has been introduced into the pelvis, is pushed out through the cortex at that point. A piece of stout silk is then attached to the bulbous tip, withdrawn through the kidney and out of the opening in the pelvis and to this is attached the winged catheter. We as a rule use a winged catheter of No. 22 to 24 French. The end of this catheter should be trimmed off to a point. Traction on the suture then draws this catheter accurately along the line created by the sound, and it fits so tightly in the renal parenchyma that bleeding will be entirely controlled. As a rule we have not thought it necessary and perhaps not wise to close the small opening made in the renal pelvis but have allowed this to remain until it closes spontaneously, which will as a rule take place within a week. This winged catheter is not fastened to the kidney or to any portion of the overlying tissues and the kidney is thus allowed to decide for itself, so to speak, the position in which it prefers to lie. The drainage from these catheters has been eminently satisfactory. Experience has led us to the opinion that they should be left in place for about two weeks, at which time a straight tube can be substituted. For this purpose we use a No. 22 rectal tube which has an opening in the end and in the side. The removal of the catheter is facilitated by passing through it a stilette, when traction on the catheter will smooth out the wings of the catheter so that it does not lacerate the renal tissues. If the straight tube is immediately replaced and if care is taken to see that it penetrates for exactly the same distance most satisfactory drainage can thus be obtained. After the first change there has been no subsequent difficulty and after a few weeks the patient can as a rule have the tube changed by some member of the family.

This technic seems to us to involve less injury to renal tissue than previous methods. By drawing the tube outward through an opening much smaller than its own dilator the oozing from the renal parenchyma is entirely controlled. We have seen little, if any, bleeding following the procedure and have as yet seen no immediate or fulminating infection, although it may be admitted that any laceration of the renal parenchyma will under suitable conditions of previous infection give rise to this dread complication.

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THE LIMITATIONS OF INTRAVENOUS UROGRAPHY

WILLIAM F. BRAASCH, M.D.

From the Section on Urology, The Mayo Clinic, Rochester, Minnesota

Opinions as to the practical value of intravenous urography differ widely. Certain observers are enthusiastic about it and employ it frequently; others do not consider it of much value. Many employ it with variable results, often finding it of great diagnostic aid and almost as often quite disappointing. Only a few observers believe that it affords sufficient evidence in most cases to establish a diagnosis without the aid of cystoscopic data. After several years' experience with intravenous urography, questions as follows may well be asked: Of what practical use has this method been? In what group of cases has it been of particular value? In what respect has it been misleading? Is it ever sufficient in itself to make possible a diagnosis without cystoscopic data? In what type of cases has it been particularly disappointing?

Experience at The Mayo Clinic has shown that the method is probably of most value in visualizing the renal pelves in cases in which it is impossible or inadvisable to attempt cystoscopic examination and ureteral catheterization. Patients of this type are being seen in increasing numbers; they include not alone children and patients with grave anatomic lesions, but patients who are intolerant, or feeble, and those with moderate renal insufficiency.

If it were not for the exorbitant cost of the iodine compounds now on the market, urography would be employed even more widely in cases in which there is the slightest doubt of renal involvement. It has been of great diagnostic value to the general practitioner in determining the evidence of urinary stasis. It is also being widely employed in the identification and localization of renal and ureteral lithiasis, and associated complications. As a test of renal function it has been of great clinical value. Visualization of the pelves within a normal time after injection can be regarded as a positive indication of normal renal function. I have yet to observe a case in which such visualization was possible and renal insuf-

ficiency was demonstrated later either by other tests or by the clinical course of the condition. On the other hand, failure of renal visualization does not signify destruction of renal function. Reflex inhibition of renal secretion is not at all uncommon with acute obstruction, particularly that caused by stone. Although it is true that inhibition of secretion is not as common as with the usual dye tests, nevertheless I have repeatedly observed complete absence of visualization of stone in the kidney or ureters, and at operation the kidney was found to be practically normal. Absence of visualization of the kidney, therefore, does not necessarily mean that the kidney is functionless.

The question as to whether intravenous urography affords sufficient data in itself to warrant surgical procedure may be answered in the affirmative in selected cases. Operation has been performed in the clinic in a number of cases in which the urogram revealed definite evidence of a pathologic condition on one side and a normal kidney on the other, so that a diagnosis could be made without other clinical data. This is particularly true concerning two conditions, namely, lithiasis and hydronephrosis. I fail to see any reason for futher investigation when there is a definite shadow of stone in the kidney which is seen to be included in the outline of the renal pelvis or calices, and when a normal renal pelvis on the other side is clearly visualized in normal time limits, or when there is definite unilateral hydronephrosis with normal visualization on the other side. It should be added, however, that in case of hematuria, the presence of pyuria, or evidence of obstruction in the lower part of the urinary tract, additional cystoscopic data would usually be necessary. Moreover, in the majority of cases in which urinary symptoms are present, intravenous urography will be only another link in the chain of clinical evidence and the cystoscopic and allied data will be necessary to complete it. Intravenous urography is being employed widely by general surgeons and diagnosticians, often with remarkably accurate results. It is not at all uncommon for general practitioners, even in small communities, to refer patients with a previous diagnosis of hydronephrosis or renal lithiasis established by means of intravenous urography. Only since the use of intravenous urography was such diagnosis possible except by the urologist. As in cholecystography, as roentgenologists and general diagnosticians become familiar with uro-

graphic interpretation they will employ urography more widely. However, there will always be a difference, as in most instances cystoscopic and allied urologic data will be necessary to establish a complete clinical picture. The general use of urography will probably be limited to the recognition of hydronephrosis, the identification of doubtful shadows, the estimate of renal function, and the demonstration of a normal pelvis. However, as Bugbee has stated, we should continue to caution those who are not familiar with urologic diagnosis or skilled in interpretation of urographic data not to place too much reliance on the intravenous urogram.

Intravenous urography has frequently been disappointing and may easily cause error in diagnosis through failure adequately to visualize the pelves and calices. It so often happens in a case in which it is most needed that visualization is so dim and uncertain as to render exact interpretation impossible. Often a fair idea may be obtained of the pelvic outline by piecing together the combined data obtained from several films taken at intervals. One of the dangers, however, of dim visualization is that the interpreter is likely to take too much for granted and assume a condition to be normal from insufficient data. The mere fact that pelves are visualized, even though incompletely, will often be sufficient to demonstrate that function remains in the kidney. When advanced disease of a kidney has been surmised from the preliminary clinical data, the value of visualizing a comparatively normal pelvic outline, even though incompletely, is self-evident. It is true that with improvement in technic and particularly in the mediums employed, progress toward better visualization is continuous; this is particularly true concerning the more recent mediums, skiodan and neoiopax. Although much has been accomplished since the employment of sodium iodide, yet the ideal medium has not been found; it is to be hoped that the future will evolve one which will give uniformly clearer visualization than is possible at present.

Intravenous urography has been most disappointing in the visualization of minor deformities accompanying tuberculosis, neoplasm, polycystic kidney, and pyelonephritis. Often only in the presence of stasis are such deformities recognized. The absence of visualization of a calix does not necessarily mean its abbreviation or a filling defect. It is frequently impossible to determine whether failure of visualization is due to a lesion in the kidney, idiosyncrasy

in excretion, or a technical factor. Fairly clear visualization on one side and poor visualization on the other does not necessarily indicate an actual pathologic condition in the latter. In fact, a pelvis which is incompletely visualized may easily be confused with deformity caused by a lesion, and in the hands of an inexperienced observer may do more harm than good. It is true that typical deformity may not necessarily be present in order to identify the lesion. For instance, in renal tuberculosis, even though the deformity may not be outlined, if there is evidence of absence of visualization on one side with normal visualization on the other, and if there is the bacillus of tuberculosis in the urine, it would be reasonable to assume that an advanced tuberculous lesion in the kidney has not been visualized. This would also be true in case of evidence of stasis on one side and a normal pelvis on the other. With stasis, and particularly with delayed visualization in one kidney, together with the finding of the bacillus of tuberculosis in the urine, the diagnosis of tuberculosis in that kidney might well be inferred. On the other hand, one could not assume that the other kidney with normal visualization is necessarily uninvolved. The data offered by intravenous urography are seldom sufficient to identify renal tuberculosis. Even though there may be normal visualization of the supposedly healthy kidney, it is necessary to catheterize it in order to exclude tuberculous infection.

Although intravenous urography is often invaluable when employed for children, yet it frequently is disappointing because of the difficulty of administering the intravenous mediums without a general anesthetic. If it is necessary to give an anesthetic, cystoscopic examination might often be employed with better results. On the other hand, as has been shown by Hyman and other investigators, the data afforded by urography are often of the greatest diagnostic value in children.

It is only in exceptional cases that deformity typical of neoplasm will be visualized clearly. Fragmentary visualization of individual calices or of the pelvis, with comparative deformity in contrast to the normal pelvis on the other side, are often the only evidences available to suggest neoplasm. Such diagnosis may be erroneous, however, since similar deformity is not infrequently observed when the normal pelvis is incompletely visualized. It is manifestly impossible to employ intravenous urography in the differentiation of

the various types of neoplasm or in the differentiation of polycystic kidney, simple cyst, and other lesions suggesting renal tumor.

Visualization of the ureter is often inadequate. Identification of shadows in the area of the lower part of the ureter may not be possible without retrograde urographic data. It is true that in the presence of stasis the shadow of the ureter can usually be identified. However, when urinary stasis is absent and the ureter is not visualized, identification of small stones in particular may be impossible. It should be remembered that the bladder must be emptied before making the late films, since the outline of the bladder usually obscures the lower ureteral area. It has been claimed that visualization of the ureter is fragmentary and incomplete when normal, and that when the entire ureter is visualized, disease is necessarily present. I have observed visualization of the entire ureter so often in normal conditions, however, that I do not regard it as evidence of a pathologic condition.

In reviewing the results of intravenous urography one must admit that it has been of tremendous aid to urologic diagnosis. Urologists certainly would not care to be without it. In the course of differential diagnosis the demonstration of normal pelves on both sides has frequently obviated the necessity for cystoscopic examination. In innumerable cases cystoscopic examination with pyelography, even if it had been possible, would have been an added burden, not alone to the physical status of the patient but to the economic status. Although it is true that one cannot always rely on normal visualization, nevertheless, in the absence of other data, one is safe in adopting its interpretation. The use of intravenous urography in the hands of the general practitioner need not be discouraged, provided the shortcomings of the method are sufficiently emphasized. By this method lesions of the urinary tract will undoubtedly be recognized which would otherwise escape recognition. The cases which are difficult of interpretation by the inexperienced observer, and which are in the majority, will of necessity be brought to those who are experienced in such interpretation.

I see no objection to relying on the data offered by intravenous urography in determining the indications for surgical treatment. In most cases of hydronephrosis and renal stone cystoscopic examination is superfluous. Occasionally this is true with regard to renal neoplasm and polycystic kidney. However, it is scarcely

ever true with regard to renal tuberculosis, since one kidney must be shown to be free from the bacillus of tuberculosis and pus by careful catheterization before removal of the opposite kidney is permissible. On the other hand, it should be emphasized that if much pus or blood is present in the urine, its source must be identified by cystoscopic examination in all such cases prior to operation. This fact, together with difficulties of interpretation, which often arise, will require the judgment of the trained urologist in most instances.

SPONTANEOUS RENO-VISCERAL FISTULÆ WITH REPORT OF TWO CASES OF RENO-COLONIC FISTULÆ

HENRY O. MERTZ, M.D.

From the Department of Urology, Indiana University School of Medicine, Indianapolis, Indiana

The unusual diagnostic and surgical difficulties encountered in one of the writer's cases, with the finding of but a single reference to a similar type lesion in the transactions of this society, have prompted this review of fistulous communication between the kidneys and adjacent viscera.

Case 1.—F. V., an Italian, male, thirty-three years old, was first seen in April, 1920, having been referred by the United States Public Health Service because of repeated attacks of right-sided abdominal pain. He was comfortable and came for an opinion as to the advisability of surgical removal of a previously diagnosed right renal calculus.

The patient had always been well until 1913, when he had a first attack of right renal colic, which was repeated in 1914 and in 1915, when he passed a stone. In July, 1918, a diagnosis of right renal calculus was made and he was discharged from the army. He was free from pain until 1920, since which time, following another acute attack of right renal colic, he has had a constant dull ache in the right loin.

General physical examination was negative except that his teeth showed many cavities and he had advanced pyorrheal changes in the gums. Abdominal examination was negative for tumor mass or tender area. He denied gonorrhea. The blood Wassermann test was negative. The urine was alkaline and contained much pus and blood. Urological examination disclosed a right calculous pyonephrosis with a moderate number of pus cells in the urine from the left kidney. The left pyelogram was normal. The roentgenologist reported the shadow of a calculus in the right kidney, while "the left kidney and bladder were free of calculi shadows." The two hour phthalein output was 62 per cent.

On October 25, 1920, a right calculous pyonephrosis was removed (Hamer). Following the operation the patient's progress was somewhat slower than normal. However, he was up and about his room, ready for dismissal from the hospital, when, on the twentieth post-

operative day, he was seized with an acute upper left abdominal pain, accompanied by chills and fever and followed by complete anuria. Catheterization of the left ureter detected an obstruction at the uretero-pelvic junction, due to a stone, which obstruction was passed. X-ray examination at this time showed several shadows in the enlarged left kidney. A diagnosis of ureteral obstruction due to a plugging stone at the uretero-pelvic junction was made and surgical drainage of the pyonephrotic kidney with removal of any stones found was advised, which counsel was refused by both patient and wife. The indwelling

Fig. 1. The larger of the two fibrin stones removed at the time of the second cystotomy.

ureteral catheter was resorted to as a means of securing temporary relief. He grew progressively more septic, the urinary secretion became less, and following an attack of acute renal retention on January 5, 1921, when the catheter was temporarily removed, re-catheterization of the ureter did not relieve the acute septic symptoms as formerly. The mass in the loin grew larger, the pain was more severe until the first week in February, 1921, when the kidney became noticeably less tender but with little variation in size. This improvement lasted but for three or four days, as the loin pain and tenderness recurred, the sepsis grew worse and on February 20, 1921, the patient died. There

is no note, during the last few weeks of his illness, of any unusual bowel condition present.

The autopsy was limited to the abdominal cavity and none of the abdominal contents could be permanently removed. All the viscera in the left half of the abdomen were incorporated in an inflammatory mass. A portion of the transverse and the descending colon were intimately attached to the pyonephrotic left kidney, the lower pole of which extended well down into the pelvis behind the sigmoid colon. On the lower, anterior surface of the pyonephrotic kidney was a fistu-

Fig. 2. The calcium oxalate and triple phosphate calculus removed at the time of the third cystotomy. The nucleus was a piece of gauze, *a*.

lous opening permitting communication with the sigmoid colon. This fistula was approximately 1 cm. in diameter and was of sufficient size to allow the passage of the smaller calculi in the kidney from the renal pelvis into the colon.

COMMENT

Satisfactory progress notes are unfortunately lacking in this case. The communication of the kidney and colon was not suspected until found at autopsy.

It is interesting that the left kidney had been reported free of renal calculi on three occasions by different X-ray laboratories over a period of two years prior to the right nephrectomy, yet twenty

days following removal of the right pyonephrotic kidney, multiple left renal calculi were clearly visible on the film. Unfortunately there is no record of differential functional tests having been made and the functional capacity of the right kidney cannot be stated. It would seem logical to suppose the extra work thrown upon the remaining left kidney, whose concentrating ability was still intact, was instrumental in the unusually rapid growth of the stones in the left kidney.

Fig. 3. Pyelogram of the left pyonephrosis, some of the injected iodide solution having passed into the descending colon.

Although a spontaneous reno-colonic fistula is established, death from sepsis, as in this instance, may be anticipated. The relief secured from such fistulous drainage is inadequate and, even though

true communication between the kidney and the colon be clinically established, surgical measures to correct the condition should be undertaken.

Case 2.—Donald H., when eighteen months of age, developed urinary frequency with pain, voiding every ten minutes to one-half hour during the day and frequently at night. He was brought to the St. Vincents Hospital, Indianapolis, where two small and one large semi-soft, yellowish white stones having the appearance of fibrin were removed from the bladder on June 23, 1928. His convalescence was normal, the suprapubic wound was healed in three weeks and he was "comfortable." Two weeks after his dismissal from the hospital, however, his urinary difficulty returned and he was admitted to the James Whitcomb Riley Hospital September 28, 1928, when he first entered the writer's service.

The family history and general physical examination were negative. There were no inflammatory changes about the previous cystotomy wound and the bladder was not distended. Neither kidney was palpable and in so far as could be determined there was no tenderness detected in either loin. Available information concerning the findings at the previous operation suggested the presence of a bladder tumor as well as the fibrin calculi. For this reason a proctoscopic examination was made, under the supposition that the prolapse of the rectal mucosa present, and the rectal tenesmus, might be due to an extension of such a bladder growth into the rectum, and not entirely the result of straining during urination. The results of this examination were negative.

The urine was acid in reaction and contained blood, pus and albumin. Urine culture showed hemolytic streptococci and proteus vulgaris bacilli.

The blood Wassermann test was negative.

X-ray examination was negative for stone shadow in the kidneys or ureters, but there was an area of increased density showing along the lower border of the sacrum, suggesting a bladder calculus.

Although the actual condition existing in the bladder was uncertain, in the light of previous operative findings it was decided to open the bladder without a pre-operative cystoscopy. Before this could be accomplished the child contracted a respiratory infection and was placed in isolation, from which he was released on October 28, 1928. On November 1, 1928, the bladder was opened and two soft stones, one 4 cm. and one 1 cm. in diameter, were removed and an Albarran siphon tube was anchored in the bladder. There was no tumor in the bladder. On November 20, 1928, a recurrence of his nasopharyngeal infection was complicated by bilateral otitis media and both ear drums were lanced. On December 13, 1928. cystoscopy through the suprapubic wound disclosed much muco-pus in the bladder with some

crystalline material. Repeated cystoscopies, previous to and subsequent to this date, failed to verify this finding and the bladder was allowed to heal January 15, 1929. Continuous bladder catheter drainage and frequently kidney pelvic lavage were employed, yet the urine remained turbid and the bladder grew more irritable. Cystoscopy on February 28, 1929, disclosed a small stone in the bladder. At this time another acute nasal infection and acute tonsillitis demanded his isolation, and not until April 4, 1929, was the bladder opened again. This third cystotomy was accomplished without mishap, and the stone, which was hard, composed of crystalline material with a nucleus consisting of a raveling of gauze, was removed.

Analysis of the soft stones removed in November showed them to be composed entirely of fibrin, free of crystalline material, while the small stone formed about the gauze was made up entirely of triple phosphate and calcium oxalate crystals.

Following this operation the suprapubic drainage was maintained and the renal pelves were repeatedly lavaged. On June 14, 1929, cultures from the segregated specimens were as follows: right side—hemolytic streptococci, Proteus vulgaris bacilli; left side—hemolytic streptococci, Proteus vulgaris and colon bacilli. Urine from the left kidney always contained pus cells, while the urine from the right kidney was occasionally free of pus. At no time was there residual urine detected in either pelvis. A pyelogram showed the right kidney pelvis to be normal, while through a misunderstanding no left pyelogram was made. One week after the suprapubic wound was again healed, July 21, 1929, the temperature mounted to 105°, and for the first time the patient was tender over the left loin, but the left kidney could not be palpated. In four days the temperature was normal. On August 24, 1929, the patient was released from the hospital with a normal temperature, a seemingly firmly healed wound and without any urinary discomfort but with much pus still in the urine. He was instructed to report at regular intervals to the out-patient department for treatment of his left kidney infection.

After returning home he was comfortable and did not report for treatment as instructed. On November 16, 1929, he had a chill, followed by fever, and he again developed urinary frequency with burning when voiding, and was re-admitted to the James Whitcomb Riley Hospital November 23, 1929, three months after his last dismissal. He was voiding every hour, completely emptying the bladder at each voiding. His temperature was 104° and the left kidney was tender and palpable. The suprapubic wound was inflamed and there had been some leakage of urine for three days prior to his re-entering the hospital. The bladder gradually quieted down under continuous bladder catheter drainage, yet the record shows cystoscopy performed on December 10, 1929, and on January 21, 1930, failed to disclose either ureteral orifice. An X-ray film made on November 30, 1929, one

week following the return admission, showed "several shadows lying in what was apparently an enlarged left kidney." These shadows were outlined by a narrow, peripheral margin which was distinct and definite while the body of the shadow could scarcely be differentiated from the surrounding soft tissue shadows. Examinations of films made prior to his last admission showed no such ringlike arrangement of a dense shadow-casting substance.

The patient entered the writer's service on this admission, February 7, 1930. At the time of this first visit, the following notes were made:

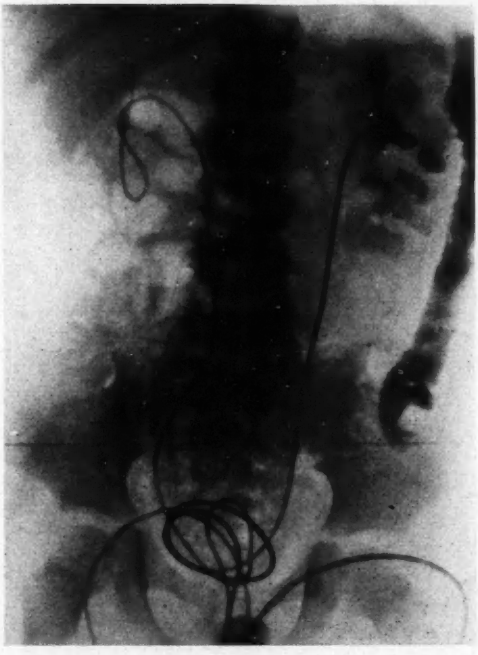

Fig. 4. Second pyelogram of the left pyonephrotic kidney, this exposure being made five minutes after the injection. The iodide solution has completely drained into the colon visualizing this organ.

He had been on continuous catheter drainage since November 23, 1929. The temperature was of a septic type, varying from 100° to 105°. The suprapubic wound was healed and free of inflammatory reaction. The left kidney was greatly enlarged and tender to touch. The right

kidney could not be felt. The patient was emaciated and weak, with a hemoglobin of 60 per cent and a white cell count of 19,800. The blood chemistry was normal. The urine contained much pus but was negative for tubercle bacilli by stain and animal inoculation. The phthalein output was reported 80 per cent in two hours and the average urine output was 18 to 20 ounces each twenty-four hours. For the past two weeks he had had from five to six liquid bowel movements each day. A diagnosis of calculous pyonephrosis was made and immediate drainage with subsequent nephrectomy advised. Before the

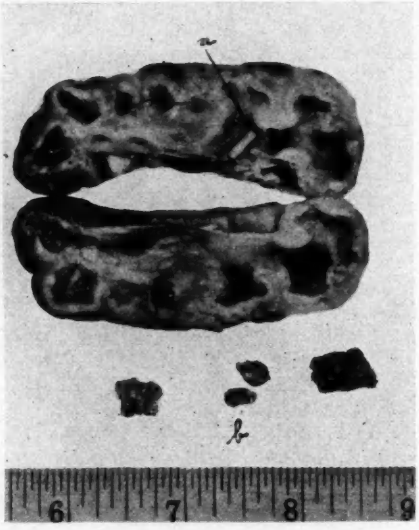

Fig. 5. The pelvis ruptured into the colon at *a*. The fibrinous matrix of the bodies of the renal calculi were dissolved in the preservative solution but the shell-like covering of the stones composed of crystalline material remained, *b*.

parents' consent could be secured, however, the mass in the loin became noticeably less, not so tender, and there was a coincident fall in temperature. There was no record of any variation of the character of the bowel movement during this time, and the passage of pus by bowel was not noted. The patient steadily improved and on February 24, 1930, cystoscopy showed the bladder free of foreign body or tumor mass. The ureters were catheterized without meeting an obstruction

on either side. On the right there was no residual urine, the drainage was free of pus and phthalein appeared in four minutes with 25 per cent output in one hour. There were 10 c.c. of purulent urine aspirated from the left kidney pelvis with none of the dye appearing in the drainage from this side. A left pyelogram was made, injecting 30 c.c. of a 12.5 per cent solution of sodium iodide. This demonstrated a dilated left kidney pelvis with some of the injected fluid lateral and adjacent to the shadow of the pelvis. A second picture, made five minutes later, showed that nearly all of the iodide solution had passed from the left kidney pelvis into the descending and sigmoid colon, visualizing these organs well. The fistulous communication was between the middle calix of the kidney and the proximal end of the sigmoid. The ureteral catheter was anchored in the left ureter and allowed to remain in the ureter until the day of the nephrectomy.

The patient improved rapidly following the anchoring of the catheter, and on February 27, 1930, a transfusion of 350 c.c. of blood was given. On March 8, 1930, a subcapsular nephrectomy was done with closure of the opening in the colon.* Although but little blood was lost during the operation, at its completion the patient was showing evidence of surgical shock, and while closing the wound he was given 200 c.c. of normal salt solution in the vein, and before leaving the surgery a transfusion of 300 c.c. of whole blood by the direct syringe method was done. His convalescence was uneventful except for a broncho-pneumonia which developed on the second day, lasting four days. He left the hospital May 3, 1930. There was still some discharge from his wound but at no time had he evidence of a fecal fistula.

He was re-admited four weeks later with smallpox, from which he recovered. All wounds were solidly healed, the phthalein output was 80 per cent in two hours, and he was having no bladder symptoms. He was finally dismissed July 30, 1930, his fourth birthday, with some pus still in his urine, but he was free of all urinary tract symptoms. The patient has not been seen since, but his parents report him in normal health.

COMMENT

Although the stones removed at the first cystotomy were not available for laboratory study, one concludes from the operator's description they were, as were those removed at the second operation, pure fibrin stones. Such a stone is soft, elastic and can more easily accommodate itself to the ureteral channel and then pass into the bladder without the usual amount of colic and pain. There was

*Dr. H. M. Trussler, of the General Surgical Staff of the James Whitcomb Riley Hospital, kindly consented to be present and coöperate in the closure of the opening into the colon.

TABLE I.—RENO-GASTRIC FISTULÆ

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Marquezy	1856			L				There was a communication between a large left pyonephrosis and the greater curvature of the stomach.	Une observation de fistule nephrogastrique. These de Paris, 1856, No. 28.
Morris	1884	26	M	L	Eleven months before seen had attack of cystitis and passed pus by bowel and in urine Five months later mass in left upper abdomen which drained in the loin by multiple openings. Diarrhea. Diagnosis of kidney abscess opening into intestinal tract.	Curettement of sinuses	Died	Autopsy: Pyonephrotic left kidney had opened into loin sinuses and into greater curvature of stomach.	Surgical Diseases of the Kidney and Ureters. Gassell & Co., Vol. i, p. 383.

The Philosophical Transaction report[1] of a case of reno-gastric fistula is not conclusive, as, although there was found in the stomach of this female patient a stone conforming in shape to the renal pelvis, and corresponding in composition to a stone present in the left pyonephrotic kidney, they could demonstrate no reno-gastric communication. The finding of food particles in the urine of Chadwick's[4] case was not sufficient to locate the fistulous communication between the urinary and digestive tract as reno-gastric. Rayer[15] concludes the following cases were instances of hysterical deception: An eighteen-year-old female who had a small stone in the bladder and who later asserted she vomited and expelled by bowel similar urinary calculi. Also a twenty-one-year-old woman was said to pass gravel by mouth, by rectum and by urethra. Rayer admits his own case of a thirty-six-year-old woman with right-sided abdominal pain was an impostor. Morris concludes the cases reported by Riverius[16] and Fernelius[7] were not conclusive. Dickinson[5] thinks Sclater's[17] case was also one of hysterical deception.

TABLE II.—RENO-DUODENAL FISTULÆ

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Campaignac	1835	45	F	R	Persistent hematuria. Later developed tumor in upper right abdomen. Vomited alkaline, offensive vomitus when tumor size decreased. Lived but three weeks after vomiting began.	Not stated	Died	Autopsy: Right pyonephrosis with obstruction of right ureter due to calculus. Kidney communicated with duodenum by direct fistula and also through a perirenal abscess.	Ref. by Rayer—Maladies des Reines, Vol. iii, p. 294.
Thirias	1888							Had an instance of reno-duodenal fistula with perinephritic abscess.	R. de Chir., 1888, p. 22.
Rolleston								Tuberculous pyonephrosis with perirenal abscess which opened into third part of duodenum.	Ref. by Henry Morris, Surgical Diseases of the Kidney and Ureter, Vol. i, p. 287.

no history of abdominal colic suggesting the passage of a kidney stone into the bladder, yet operative findings clearly indicate this did occur. The size of the larger fibrin stone, removed at the second bladder operation, indicates how rapidly these stones may grow, as but four months intervened between the first and second cystotomy. The absence of X-ray evidences of a shell-like covering of the kidney stones in earlier films seems to indicate this had formed subsequent to the second bladder operation. Doubtless a change in their environment in the kidney had caused the precipitation of these crystals. This change must have been coincident with the formation of the solid stone about the piece of gauze left in the bladder.

Much has been written concerning the formation, growth and detection of soft stone, whether albuminous, bacterial or fibrinous in structure, and reference to the literature is sufficient here.

The addition of the calcareous material to the surface of the soft kidney stone would hinder its passage down the ureter, and ureteral obstruction would more readily occur when such a change had taken place. This no doubt was a factor in the subsequent development of this patient's pyonephrosis.

The clinical record as indicated by the chart apparently establishes the fistula formation in February, 1929. At operation, one month later, while the kidney was intimately adherent along its anterior surface and outer border to the descending and sigmoid colon, and extra-peritoneal separation of the organs found difficult, if possible, by intraperitoneal gauze dissection the organs were easily separated and the fistulous tract readily identified. There was no soiling of the wound by bowel contents at the time of operation or subsequently.

Young children stand repeated major surgical operations upon their urinary tract well, yet in this case the collapse from shock at the close of the nephrectomy emphasizes how narrow a margin of safety actually exists. These little patients must be watched more closely for vascular collapse than is necessary in the adult. In this instance the loss of blood during the operation was not disturbing at all, yet the shock appeared very rapidly. Likewise the prompt recovery of the patient when given a transfusion was most gratifying and no doubt saved his life.

TABLE III.—RENO-BRONCHIAL FISTULÆ

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
DeHaen	1778	18		L	When twelve years of age noticed tumor in upper left abdomen. Had fever and pyuria. Grew weaker and developed profuse purulent expectoration.	Expectant	Died after an extreme dyspneic attack with expectoration of large amount of fetid pus	Autopsy: Tuberculous pyonephrotic kidney which was attached to diaphragm. The pelvis had ruptured through the diaphragm and had a pus cavity at base of lung which drained into a bronchus.	Ratio Medendi, in -12. Parisiis, 1778, Vol. iii, p. 103, Cop. 1.
Othmar Herr	1790			L	Following a kick by a horse developed pain in left loin which persisted more or less constantly for twelve years when developed sudden severe pain followed by expectoration of bloody, purulent sputum. Septic.	Expectant	Died	Autopsy: Hydatids of left kidney with pyonephrosis, which communicated with a perinephritic abscess. This perforated diaphragm and communicated with the lung.	De renum morbis, in -4. Halæ, 1790, p. 27. (Cas communiqué par P. E. Meckel.)
Rayer	1839	39	M	L	Suprapubic lithotomy when twenty-one years old. Passed left renal stone when thirty-two years old. When thirty-eight years old developed severe pain in left kidney region. Emaciated. Septic. Pyuria. Developed cough. Expectorated purulent material, once 9 ounces. No tumor mass in abdomen but pus in urine less after expectoration of large quantities of pus. Last few days had diarrhea.	Expectant	Died	Autopsy: Calculus pyonephrosis opened into perinephritic abscess. This extended through the diaphragm and emptied into a bronchus. There was a renal calculus in the passage between the lung and renal pelvis.	Maladies des Reins, Vol. iii, p. 313.
Sposer	1840	19	M	R	Had pain of unknown cause in upper right abdomen and right lumbar region. Pain in right lung with coughing and expectoration of purulent material.	Expectant	Died	Autopsy: Right-sided pyonephrosis communicating with perinephritic abscess which had perforated the diaphragm and passing through the lower lobe of right lung had emptied into a bronchus.	Abces du rein qui s'est fraye un chemin par le foie et le poumon. Gazette med. de Paris, 1840, p. 509.
Marcet	1853	27	M	R	Right kidney injury followed by tumor mass in right loin. Fever, pyuria, cough and purulent expectoration.	Expectant	Died	Autopsy: Calculous pyonephrosis which communicated with a perinephritic abscess which had perforated the diaphragm and opened into the right lung. Also the abscess had opened into the colon.	Bull. de la Soc. Anat., 1853, xxviii, p. 56.

TABLE III.—RENO-BRONCHIAL FISTULÆ—(CONTINUED)

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Gordon	1865	24	F	R	Passed urinary gravel for one year. For three months persistent cough with purulent expectoration. Fever, pyuria and night sweats. Physical signs of abscess in right lower lung, and mass in upper right abdomen. Gangrenous odor to breath and expectoration few days before death.	Expectant	Died	Autopsy: Abscess in lower right lung, perinephritic abscess passing back of liver communicating below with kidney and above with lung. Calculous pyonephrosis. Two ulcers of duodenum.	Case of reno-pulmonary fistula; ulceration of duodenum. Dublin. Q. J. M. Sc., 1866, xli, 90-95.
Hortoles	1878	24		R	Symptoms of renal tuberculosis. Tumor upper right abdomen and right loin. Later cough and expectorated pus. Also edema of penis and scrotum. Septic.	Perirenal abscess opened and drained twice	Died	Autopsy: Tuberculous, cystic right kidney which communicated with perirenal abscess and right lung.	Lyon Medical, 1879, i, 30.
Roubier	1920	19	M	R	A condition diagnosed la grippe was followed by urinary frequency, dysuria and lumbar pain. Developed pain in right loin with chills and fever. Vomited and expectorated quantities of pus. Entered hospital for pulmonary tuberculosis. Radioscopic findings indicated a subdiaphragmatic sac of purulent material with bolus of gas on surface. Tubercle bacilli found in sputum. Before death developed abundant hematuria.	Opened subdiaphragmatic abscess and drained	Died	Autopsy: Abscess cavity perforated diaphragm, penetrated lower lobe of right lung and entered bronchus near hilum. Tuberculous pyonephrosis with rupture of abscess in upper pole, communicating with subdiaphragmatic abscess.	Abces froid Perinephritique ouvert dans les Bronches au Cours d'une Tuberculose Renale Latente (Fistule Reno pulmonaire Tuberculeuse). Jour. d'Urol., March, 1922, xiii, No. 3, p. 196.
St. Bartholomew Hospital Case					Museum specimen			Pyonephrosis ruptured into colon and having perforated diaphragm opened into lung also.	Henry Morris: Surgical Diseases of the Kidney and Ureter, Vol. i, p. 388.

In Dickinson's thirty-three-year-old man there are not sufficient data to justify the kidney communicated with the perirenal abscess. Ducasse[6] reported an instance of a perirenal tuberculous abscess in a man observed by Thomas, with a fistula existing between the perinephritic abscess and the bronchus, with possibly the kidney communicating with the bronchus. In the Dublin Medical case, a twenty-four-year old woman with right calculous pyonephrosis, and in H. A. Fowler's[9] report of a young man with a left renal tuberculosis, the diaphragm was not perforated in either instance.

TABLE IV.—RENO-COLONIC FISTULÆ

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Portal	1767	50	M	L			Dissection specimen	Calculous pyonephrosis communicating with colon.	Anat. Medicale, iv, 380.
Lassus				R	Pus in stool			Fistulous connection of right pyonephrosis and ascending colon.	Pathologie Chirurgicale, ii, 138.
Baillie	1815				Pus was evacuated by the anus	Expectant	Died	The kidney communicated with the colon.	Anat. Patholog. trad. Guerbois, p. 130 in 8°, Paris, 1815.
Rayer	1829	Young	F	L	Painful upper left abdominal tumor for five months. Fever. Later severe diarrhea and passed pus by the bowel when tumor mass decreased in size.	Expectant	Died of sepsis	Autopsy: Left pyonephrosis which had drained into descending colon by a fistulous tract. Obliteration of left ureter due to unknown cause.	Maladies des Reins, 1841, Vol. 3, p. 304. Case reported also by Bonnet, Journal hebdomadaire, t. vii, p. 397.
Cruveilhier	1833		F		Prolonged hectic fever, cause of which was not known.	Expectant	Died	Autopsy: Bilateral pyonephrotic pelvic kidneys, one communicating by a fistulous tract with the rectum.	Anatomie Descriptive, tome, ii, p. 694.
Rayer				L		Expectant	Died of sepsis	Autopsy: Left tuberculous pyonephrosis opened into descending colon.	Maladies des Reins, 1841, Vol. iii, p. 305.
Parmentier	1851	55	F	R	Painful tumor in upper right abdomen which decreased in size when persistent diarrhea developed. Pain and tenderness in right loin constant. Urine cloudy.	Expectant	Died of sepsis	Autopsy: Calculous pyonephrosis with drainage of a calyx into a perinephritic abscess which in turn drained into ascending colon.	Absces Perinephritiques. Le Union Medicale, 1862, Vol. xv, p. 441.
Nairne	1852	31	F	R	Loin and abdominal pain followed by appearance of upper right abdominal tumor. Pyuria. Eight months later developed diarrhea and passed an uric acid and calcium oxalate calculus by the bowel. Constant diarrhea. Septic.	Expectant	Died of peritonitis	Autopsy: Calculous pyonephrosis adherent to and communicating with hepatic flexure of colon by fistulous tract. Peritonitis thought due to leak of purulent material into peritoneal cavity from about fistula.	Reported by Dickinson—Renal and Urinary Affections. London, 1883, Vol. iii, p. 946.

TABLE IV.—RENO-COLONIC FISTULÆ—(CONTINUED)

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Sangalli	1864	34	F	R	Following exposure developed pain in upper right abdomen with fever. Gradually grew worse. Dysuria. Hematuria. Intermittent swelling in upper right abdomen. Oil taken for cathartic appeared in urine. Vegetable matter in urine. Septic. Some diarrhea.	Expectant	Pt. emaciated, cachectic but author does not record death	From clinical findings concludes "had a right infected hydronephrosis which had become attached to, and ruptured into the gut. Probably cancer was back of it all."	Fistola Nephro-enterica acquisita diagnosticata col mezzo d'indagini fisio-pathologische e micro-chemiche. Gior. di anat. e fisiol. pathol., Milano, 1866, iii, 370-377.
Ogle	1867	31	?	R	Perinephritic abscess with patient later discharging calculi through intestinal tract.	?	?	Diagnosis made through passage of urinary calculi by bowel.	St. George's Hospital Reports, 1867, p. 373.
St. Thomas Hospital Case	1883			L			Died	Autopsy: Calculous pyonephrosis which opened into circumscribed abscess between kidney and gut, which in turn communicated with descending colon.	Ref. by Dickinson—Renal and Urinary Affections, London, 1883, Vol. iii, p. 947.
St. Bartholomew Hospital Case	1883			L	Recurrent attacks of renal pain which had been relieved by the evacuation of pus by the bowel.		Died	Autopsy: Pyonephrosis opened into descending colon by two openings. There was a calculus in lower ureter.	Ref. by Dickinson—Renal and Urinary Affections, London, 1883, Vol. iii, p. 947.
J. Israel and Doering								Observed large pyonephrosis opening into large intestine.	Ref. by Selleras and Vilar. La Semina Medica, 1929, xxxvi.
Rafin								Had instance of tuberculous pyonephrosis perforating into the colon.	Ref. by Selleras and Vilar. La Semina Medica, 1929, xxxvi.
Scholl and Judd								Report an instance of fistula between kidney and colon.	Ref. by Selleras and Vilar. La Semina Medica, 1929, xxxvi.
Fantoni								Observed nephro-colonic fistula.	Anat. Corp. human, diss. iv, p. 160.
Duverney				L				Left kidney opened into colon.	Anat. Corp. human, Cop. 14.

TABLE IV.—RENO-COLONIC FISTULÆ—(CONTINUED)

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
Weigel				L	Diarrhea and purulent stools.			Kidney had ruptured into colon.	Ital. Med. Chir. Bibl. Bii, St. ii, s 206.
Wys			M		Long standing severe renal pain. Pus in stool.		Died	Autopsy: Colon and pyonephrotic kidney communicated by two fistulæ.	Museum der Heilkunde, Bi, Nii, S12.
Tuffier	1889	Young	F	R	Sepsis; pyuria and tumor mass in upper right abdomen.	Nephrotomy	A fistula remained in loin, discharging mucopurulent material	Author states the pyonephrosis had opened itself into the ascending colon.	Author writing in surgery by Duplay and Reclus. Vol. vii, p. 271.
Mouchet	1891	26	F	L	Following left-sided abdominal pain developed tumor mass in upper left abdomen with perinephritic abscess. Later oliguria and diarrhea with pus in the stools. Passed ascaris lumbricoides from wound.	Opened perinephritic abscess	Cured	Diagnosis of communication between kidney and perinephritic abscess made at time of operation. Concluded fistulous opening existed between gut and perinephritic abscess from diarrhea, pus in stools and passage of worm by wound.	Issue d'un ascaride lombricoide par une fistule lombaire onze mois apres l'incision, d'un phlegmon perinephritique; cicatrisation rapide de la fistule. Gaz. d. hop. Paris, 1894, lxvii, p. 641.
McLaughlin	1903	37	M	R	History was that of bladder stone. No history of diarrhea.	Suprapubic lithotomy	Died third day following operation	Autopsy: Ureters dilated. Right pyonephrosis communicated with colon by fistulous tract 1 inch long. Calculi and cysts of left kidney.	Pyonephrosis with a kidney colon fistula. Jour. A. M. A., July 11, 1903.
Watson and Cunningham	1907	35	F	L	Pain in left kidney region with mass in upper left abdomen. Patient critically ill with urosepsis. Constipated.	Drained abscess of upper pole through a loin incision	Died second day following operation	Autopsy: Anterior surface of pelvis and kidney adherent to descending colon with fistulous communication of pelvis and gut, which authors conclude had occurred but short time before death.	Genito Urinary Diseases, Vol. ii, p. 159.
Eugene Fuller	1911	?	M	?	Pneumaturia, with passage of small amount of bowel content in the urine.	?	?	An abscess of the pelvis of the kidney had ruptured into the bowel. The gas entered the bladder through the ureter.	Discussion. Tr. Am. Assn. Genito-Urinary Surgeons, Vol. vi, 1911.

TABLE IV.—RENO-COLONIC FISTULÆ—(CONCLUDED)

Name	Year	Age	Sex	Side	Clinical History and Physical Findings	Treatment	Termination	Operative or Autopsy Findings	References
D'Allaines et Rouffiac	1919	56	M	L	Abdominal pain, at times colicky, emaciation and obstructive diarrhea, with blood in stools. Small solid bosselated tumor in upper left abdomen. radioscopy showed obstruction of sigmoid colon. Diagnosed as neoplasm of colon.	Removal of left kidney and part of transverse and descending colon	Died 24 hours following operation	Abscess of lower pole of kidney communicated with colon which discharged pus and blood into gut. Did not open into renal pelvis.	Fistule perinephrocolique avec lesions inflammatoires du rein. Bull. et Mem. Soc. Anat. de Paris, 1923, xciii, 324-327.
S. Œconomos Case I	1921	47	M	R	Urinary infection following urethral dilatation. Fever, chills, perineal abscess, right renal pain, with multiple parenchymal abscesses of right kidney. Following nephrostomy, fever persisted and developed diarrhea with some blood, and evacuated pus and blood per rectum.	Drained right kidney	Died three months following operation.	Diagnosis made from clinical findings, of right pyonephrosis which communicated with colon.	Deux cas de fistules renointestinales. Proces-Verbaux, Memoires et Discussion; Vingt-deuxieme Congres Francais d'Urologie, Paris, October, 1922, p. 596.
S. Œconomos Case II	1921	16	M	R	Had nephritis. Contracted gonorrhea which was complicated by right epididymo-orchitis. Later right pyonephrosis. Mass upper right abdomen. Surgery refused. Diarrhea, and passed uropurulent material by bowel.	Refused surgery	Died	Passage of uropurulent material by bowel sufficient for diagnosis in presence of enlarged right kidney.	Deux cas de fistules renointestinales. Proces-Verbaux, Memoires et Discussion; Vingt-deuxieme Congres Francais d'Urologie, Paris, October, 1922, p. 596.
Gerard	1921	45	F	L	Perinephrietic abscess of undetermined origin drained in 1913. In 1921 had developed intestinal fistula with discharge through wound. Catheterized left ureter and found left kidney destroyed and communicated with descending colon.	Opening of perinephritic abscess in 1913. Left lumbar nephrectomy with closure of opening in colon	Cured	Diagnosed by fecal discharge from wound and finding of left pyonephrosis.	Discussion: Proces-Verbaux, Memoires et Discussions, Vingt-deuxieme Congres Francois l'Urologie, Paris, October, 1922, p. 601.
Selleras and Vilar	1929	20	F	R	Right renal colic in 1925, since which time has had pyuria and frequency with, recently, fever and upper right abdominal pain with mass in this region.	Subcapsular nephrectomy with closure of colonic opening	Cured	Diagnosed by pyelography which showed fistulous tract and point communication of right pyonephrosis and cecum.	Spontaneous renocolic fistula of renal tuberculosis. Diagnosed by pyelography. La Semana Medica, 1929, xxxvi, p. 1196. This case reported also by Blanco, La Semana Medica, 1930, xxxvii, p. 290.

Reno-colonic fistula occurred in Annandale's[3] case fifteen days after drainage of a lumbar abscess. On the third day following drainage of an abscess of the upper pole of a right kidney, H. A. Fowler's[9] case developed a fecal fistula. Fowler's explanation of the method of production of this type of fistula is probably the correct one.

DISCUSSION

Fistulous communication of the kidney with adjacent viscera is today a rare condition. Modern diagnostic and surgical procedures have so nearly eliminated its development it has almost become a pathological curiosity. In renal suppuration, symptoms indicating approaching fistula formation with a neighboring viscus are seldom encountered, and the treatment of the established fistula is superseded by its prevention in early surgical drainage. While there remains most an historical interest in what was once a vital surgical problem, yet its occasional occurrence gives to it still some diagnostic and surgical importance.

Rayer appreciated the significance of the subject in his day and he collected and summarized the available information prior to 1841. Morris in 1901 added to the knowledge of the methods of development of the various types of reno-visceral fistulæ both by record and by personal observation. Trosseau[18] (1865), Bowditch[3] (1870) and Goldenhorn[10] (1898), have each studied the visceral fistulæ following the spontaneous rupture of a primary perinephritic abscess. More recently the reviews of Roubier (1922), and Pangon[14] (1922), in reno-bronchial fistulæ, and of Œconomos (1922), and Selleras and Vilar (1929), in reno-colonic fistulæ, have indicated the additional information acquired by modern diagnostic methods and its utilization in the treatment of their respective type lesions.

Of the forty-two cases of reno-visceral fistulæ collected from the literature, there were two reno-gastric in type, two reno-duodenal, nine reno-bronchial and twenty-nine reno-colonic. From this series it is evident spontaneous rupture of a pyonephrosis into the stomach or duodenum is unusual and will be an extremely rare clinical finding. Spontaneous fistulous communication between the ureter and the gut is not included in this review.

The recital of Roubier's case of reno-bronchial fistula in a renal tuberculosis indicates how confusing the clinical symptoms may be and the difficulties encountered in making a diagnosis of this type of fistula. The pulmonary symptoms may so completely dominate the clinical picture that the clinician is often content with a diagnosis of a primary pulmonary disease and the fistulous communication between the two organs is not suspected prior to autopsy. In this series the fistula connected the right kidney and

right lung in five cases. In but one instance (DeHaen) was the kidney directly adherent to the diaphragm. A perinephritic abscess was present in the remaining eight cases. In two instances there was a communication between the kidney and a perinephritic abscess, which latter had opened into the bronchus above and the colon below, thus allowing the kidney to communicate with both the lung and the gut. So common a sequence of a neglected perirenal abscess is a bronchial fistula that Morris states "it is probably not an exaggeration to say that of every ten cases of primary perinephritic abscess allowed to follow their own course, four or five will open into the respiratory tract." This is a grave complication as "the termination of such a fistula is death from septicemia or from dyspnea and exhaustion due to incessant coughing and the expectoration of large quantities of pus." Bowditch was one of the first fully to appreciate this surgical problem and in reporting, in the first volume of the Transactions of the Boston City Hospital, his three cases of rupture of perirenal abscess into the bronchus, he advocated early, free drainage of the loin abscess before the bronchial fistula has developed as the only means of saving the patient's life.

Of fifty-five cases of presumably primary perinephritic abscess developing visceral fistulæ, twenty-three opened into the lung. It is probable the kidney communicated with the perinephritic abscess in certain of these cases, yet the data are insufficient to justify their being classed reno-bronchial fistulæ. Such was the circumstance in the following observation:

Mr. A. N. entered the Robert W. Long Hospital, Indianapolis, March 24, 1916. with a diagnosis of left perinephritic abscess, pulmonary tuberculosis, and tuberculosis of the left kidney. For six months there had been urinary frequency and burning. In January, 1916, a mass was detected in the left loin. A cough had been present for two years and on March 23, 1916, the day prior to his admission, following a severe coughing spell, he expectorated a pint of thick pus. Two days after entering the hospital the perinephritic abscess was drained (Wishard), when the expectoration was much lessened. Following the establishment of loin drainage the patient could freely breathe through the loin wound when the nostrils and mouth were left closed. The patient died of sepsis May 8, 1916. No autopsy was permitted.

Instances of reno-colonic fistulæ have been reported during recent years and the details of these cases record the employment of mod-

ern diagnostic and surgical measures in their detection and management.

In twenty of the twenty-nine cases of reno-colonic fistulæ the communication of the kidney with the gut will be direct in the majority of instances, the opposite to the condition in reno-bronchial fistulæ. That the kidney ruptures directly into the colon no doubt accounts for the relatively greater frequency of this type of renal fistula and explains its still being occasionally observed. A perinephritic abscess will have been recognized and drained before it has had opportunity to perforate the diaphragm and rupture into a bronchus, while it would seem occasionally a pyonephrotic kidney will open into the colon before it is operated on. In one case of bilateral pelvic dystopia, the pyonephrotic kidney opened into the rectum. In the remaining cases the kidney communicated with equal frequency with the ascending or descending colon.

The treatment of an established reno-colonic fistula is nephrectomy with closure of the opening in the gut.

Pneumaturia, the colonic gas entering the pelvis and reaching the bladder through the ureter; vegetable matter in the urine; the passage of urinary calculi or the evacuation of a large amount of pus by the bowel, may indicate the development of the kidney-colon fistula. Pyelographic evidences of the communication between the kidney and the bowel, however, as in the case of Selleras and Vilar and the writer's Case 2, may be the first intimation that such a condition exists.

I have found no instance of reno-gastric fistula or reno-duodenal fistula diagnosed clinically. While reno-bronchial fistula has been recognized, I know of no case in which the patient recovered. The diagnosis of Ogle's case of reno-colonic fistula was based upon the passage of renal calculi by bowel. In the observations of Mouchet, Tuffier and Œconomos there was the passage of purulent material by rectum with a coincident lessening in the size of the loin tumor. Gerard, Selleras and Vilar and the writer, in Case 2, detected the communication between the kidney and colon by urological study. In these seven cases of reno-colonic fistulæ diagnosed clinically, the patients were operated on. In four simple drainage was done with a mortality of 50 per cent, and in one case surviving there was a persistent fistula in the loin. Gerard, Selleras and Vilar, and the writer removed the kidney and closed the fistulous opening into the colon.

These three patients were cured. The patient in the case of D'Allaines and Rouffiac, who had erroneously diagnosed a carcinoma of the colon because of a filling defect discovered upon examination with a barium enema, died following the removal of a portion of the colon as well as the kidney.

1711 North Capitol Avenue.

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DISCUSSION

Dr. Arthur Crosbie (Boston): I was delighted to hear Dr. Cabot advocating nephrostomy for the sort of cases that he presented. I am sure that it is an operation that is not used as much as it should be. Having been brought up as a disciple of Dr. Chute, I have always been very fond of this operation and have used it a great deal, especially in cases of infected hydronephrosis and kidney stones where there is much infection. I think it is exceedingly important to drain the kidney this way in the hope of preventing the recurrence of stones in the future.

The method that I use for doing the nephrostomy is merely to hold the kidney in my left hand, with the fingers on the kidney pelvis. I then make a small nick through the capsule in the so-called White line, and introduce a half length down into the kidney pelvis until I can feel it with my fingers, and then follow that with either the little finger or the forefinger of the right hand and explore the pelvis, removing any stones that may happen to be there. I put in a tube that is large enough to fit pretty snugly in the nephrostomy opening. Of course, at the very first the bleeding is quite profuse but after the tube is in and the kidney dropped back it rarely ever bleeds enough to amount to anything. Occasionally, where I have had to pull out a large stone, I do pack down a wisp of gauze alongside the tube, but as a rule as soon as the tube is introduced and the kidney dropped back off tension, the bleeding will stop immediately.

Dr. H. G. Fuller (Washington, D. C.): Speaking of cases of hematuria with a terminal diagnosis of arteriorenal disease recalls to mind very vividly a case some years ago of very marked hematuria. This went on and it was seemingly impossible to make a satisfactory pre-operative diagnosis that would account for so much bleeding. It was from the left kidney. An extensive nephrotomy was done and a section removed at the time of operation for further pathological study. The kidney was sewed up, sutured, and the patient went on to an uneventful recovery. I believe the report from the pathological laboratory was a glomerular nephritis.

This patient went on very happily for a few years. He was rather a young man in his late twenties or early thirties. He had absolutely no hemorrhage for three years and he died about nine years after the operation with a diagnosis of arteriorenal disease.

Dr. George R. Livermore (Memphis). Dr. Cabot brought up a subject of very great interest to me—the re-formation of stones. I do not see how we can say, though, that the removal of one kidney would probably disturb the chemistry and cause the recurrence of stone any more than we can say that the removal of a stone from the kidney would also produce this same chemical disturbance, because we have recurrence from nephrotomy or from pyelotomy just as we do where the kidney has been removed entirely. All of us, doubtless, have had the same experience in removing a kidney.

I have in mind a patient who had a very large hydronephrosis with a ureter that looked almost like the small intestine in size. This patient was subjected to a nephrectomy and did beautifully for about a year and a half. The patient then returned, complaining of pain in the opposite side. The other kidney had been practically free of trouble, had been irrigated and cleared up entirely before the patient was finally discharged. When he returned a year and a half later he had a stone completely filling the pelvis of the remaining kidney. That bears out Dr. Cabot's theory of removal of the kidney causing some chemical disturbance, and yet we have had the same experience when we have removed stones by a pyelotomy or by a nephrotomy.

In regard to nephrostomy it has always seemed to me that it is a serviceable operation in many types of cases. I would like to cite a case in which a young woman thirty years of age had a double pyelonephritis. On one side there was a double nephrosis with a practically destroyed kidney on the other side. There was a marked pyelonephritis. We cleared it up to such an extent that we felt justified in removing the kidney. This was done until only an occasional pus cell was demonstrated in the kidney. This patient returned home and came back to us in about twelve months with complete anuria that had lasted for four days. We felt that something should be done immediately, so we put in a ureteral catheter and tried simple lavage and drainage produced by the catheter for another twelve hours, with all the other things that we

do, like hot packs and intravenous treatments, and so forth, without any effect whatsoever on bringing about any secretion of urine. We then took the patient to the operating room and did a nephrostomy. I didn't put in as large a tube as Dr. Cabot suggests but we did use a small No. 16 French catheter. Secretion started almost immediately on the return of the patient to her room and inside of two days she was practically normal again. This was over two years ago.

At the time of examination later we found a stricture at the ureteral pelvic junction. I have removed the tube and tried to dilate the structure but every time that is done the patient has severe rigor, and if we remove the tube she goes back into the pyelonephritis. The replacement of the tube immediately restored her condition, so the patient now has worn this tube for about five years, and is absolutely comfortable. She feels so well that she does not come back any longer to have dilatation.

Dr. Edwin Davis (Omaha): In connection with Dr. Mertz' discussion of nephro-visceral fistula, I wish to refer to a case of spontaneous fistula between the right renal pelvis and the duodenum, reported several years ago. This patient was a middle-aged man complaining of intense bladder symptoms, intense frequency, dating back four years following what he considered to be typhoid fever, with some pain in his flank, which I interpreted as having been a perinephritic abscess. The patient got immediate relief from these symptoms following nephrectomy, so we interpreted these symptoms as being due to the pancreatic juice and small amounts of trypsin in the bladder.

Dr. Roger C. Graves (Boston): With Dr. MacKenzie's paper in mind I should like to place on record briefly a case that I have seen recently, that was interesting and rather difficult from a diagnostic point of view in that the patient presented three possible causes for hematuria. He was an able-bodied, well-nourished man of about forty, who complained of the passage of very bloody urine. As I recall it, pain had not been present, or at least certainly had not been a prominent feature in his case. He was difficult to examine cystoscopically because his urine was very bloody, but in an attempted bladder inspection it was possible with a good

deal of washing to see that he had a bloody efflux from his left ureter and to see also that he had on the floor of his bladder an irregular, spiculated black stone. I assumed that probably he had hematuria from the trauma of the passage of this stone down his left ureter and that bleeding was possibly more persistent than usual merely from that cause.

After keeping him quiet for a few days, in which time we had more than the usual difficulty in stopping the bleeding and finally had to resort to hemostatic sera, and so on, I used the cystoscope again and with the cystoscopic rongeur removed the stone. At that time, with the clearer visualization, it was possible still to see some bloody efflux from the left ureter and to see also what I could not see at the first examination, the presence of a small papilloma around the opening of the left ureter. I felt then that the probable diagnosis was that of papillary tumor of the renal pelvis or ureter on the left side, or both, and that it was far safer to the patient to subject him to complete nephro-ureterectomy than it was to run the risk of missing such a tumor.

First, in preparation for the operation, I destroyed the bladder papilloma by means of fulguration and then subsequently performed a complete nepho-ureterectomy down to the bladder wall. At the time of the operation the renal pelvis felt thickened and a little larger than normal, as did the upper ureter, so I felt justified in going ahead with my radical operation, feeling that there was evidence of possible growth in the renal pelvis. I felt, of course, that it was unwise to open the structures at that time. I found on sectioning the gross specimen, however, after its removal, that it did not show, either in the kidney or in the entire length of the ureter, any evidence of tumor. The pathological report was that of varices of the renal papillæ, the so-called papillitis that has been frequently reported in recent years.

The patient made a very satisfactory recovery. I have seen him recently and have inspected his bladder, which is entirely free from any evidence of growth and shows merely the dimpling at the point in the bladder where it was opened at the time of the ureterectomy.

DR. JOHN H. NEFF (University, Va.): I would like to report a case that may be pertinent to Dr. Hagner's report in that the

patient had a little hematuria and angioneurotic edema. His main complaint, however, was kidney colic. He had had three attacks of kidney colic, so severe that he could not be controlled by the usual hypodermics and he had finally been given chloroform. These attacks occurred on both sides, two attacks on one side and one on the other. He later went to Baltimore and was examined there and told that he had a kidney stone on one side. He happened to find out that the X-ray man didn't agree with the urologist's diagnosis and took French leave. We later saw him after his third attack. He had had two at the time he went there. All examinations with us were entirely negative—X-ray, cystoscope, pyelograms, functions, and so on. He had passed a little blood in his attacks in Virginia. We could find absolutely nothing to account for his attacks. He gave a history, however, of having had allergic manifestations all his life. He would have a swollen finger or lip or what-not, two or three times a week, and he had been tested out for the various protein reactions both with us and in Baltimore and all had been negative.

It occurred to me, as a spark in the dark, that he might be having kidney colic from angioneurotic edema involving his ureters very much as one may get a similar thing simulating intestinal obstruction from a bowel involvement. So we advised him in his next attack, if he had any more, to have his physician give him a hypodermic with adrenalin. The result of that was very dramatic. In his next attack, having secured no relief from morphine, he finally obtained a hypodermic of adrenalin, and received complete relief.

I cannot recall having seen a reference to any similar condition, though I haven't looked the matter up in any careful way.

Dr. Arthur B. Cecil (Los Angeles): In the application of Dr. Cabot's nephrostomy I might report a case that I had at one time of a patient who had a remaining kidney with obstruction to the ureter. The man was in very bad condition from anuria and in operating to remove the obstruction of the ureteral stone I decided to do a nephrostomy and put in a large tube. To my amazement, all of these stones in the kidney, which were widely distributed, came out through the tube and have never re-formed.

It occurred to me that in operating in cases of bilateral stone in which stones are widely distributed in the kidney it might be a very good thing to leave in a very big tube; there being a possibility of the stones coming out. That is what happened in this particular case.

In regard to the spontaneous nephrovisceral anastomosis, I have diagnosed a case of anastomosis between the right kidney and duodenum, but the right kidney was tuberculous. I think the case presents a very serious problem. I doubt whether one could take out the kidney and be able to close the duodenal fistula, so I have done neither.

We had other cases in which the kidney was anastomosed with the large bowel. Of course, they were very much simpler.

DR. A. RANDALL (Philadelphia): We have all experienced these recurrent stones, such as Dr. Cabot describes. In the vast majority of cases they are phosphatic, and, as may be recalled, there has been some interesting work done on the formation of phosphatic stones in Vitamin A deficiency. The result is that we put all our men now, after they have had an operation, on a high Vitamin A diet. We are watching them with interest. We can't report anything positive yet. We shall have to wait until time answers it. But it is a thought that I would like to leave with you.

In discussing Dr. Braasch's exposition of pyelography, in which I thoroughly concur, I think he left out one point, which we have found of greatest value, and that is the use of uroselectan to determine operation or instrumentation in ureteral calculi. If there is a complete block, surgery is immediately indicated. If by uroselectan one can demonstrate that it is not a complete block, that the kidney is functioning past, one can hesitate and try various methods of instrumental delivery.

We encountered that picture two weeks ago when a man who had been studied by a very good young doctor was referred to me. The doctor sent him to me with a plate which showed a typical low ureteral stone. This patient entered the hospital late Monday evening. Having seen the plate, I asked that there be a uroselectan study done the next morning. At one o'clock the next day that uroselectan study showed a decided pathological change on the

side that the stone was on, characteristic of the picture which we now recognize as renal tuberculosis. The stone shadow was ruled out. The opposite kidney showed a normal topography and excellent functioning. That afternoon tubercle bacillus was demonstrated in his urine. Therefore, in thirty-six hours, without instrumentation, this man's diagnosis was complete and he was ready for operation.

I must confess that I wasn't willing to put all my diagnosis on a new method such as this. Subsequently, the following day, a cystoscopy with the differential function test showed 3 per cent from the defective side and 22 per cent from the opposite side. It simply corroborated the original diagnosis, but it was a pretty illustration of how easily, how quickly and accurately in a very short space of time a complete urological study can be made.

DR. EDWARD L. KEYES (New York City): On Dr. Braasch's paper, which was very interesting to me, I would like to protest, if I understood him correctly, on his one very favorable statement in reference to the use of uroselectan, that it showed kidney function more accurately than the dye; yet later in the paper he seemed to say something that was opposed to that. Did I misunderstand you there, Dr. Braasch?

DR. BRAASCH: I think so.

DR. KEYES: Then I am much happier.

In reference to chloroform for renal colic, I am moved to state that I have been playing for some years past with spinal anesthesia for the relief of severe renal colics and it happened to work very well in those cases that I felt it was worth trying on.

I cannot altogether follow Dr. Randall's remarks in favor of uroselectan. I followed his practice better than what he seems to think is his theory, as to the diagnosis of his tuberculosis case through the use of uroselectan, checking it up by cystoscopy. I don't see why uroselectan proof of complete stoppage of a ureter by stone would be particularly moving inasmuch as the stoppage, I think, is so variable. As long as the patient is having colic, I think there is some reason to believe that there is not complete stoppage. I distinguish between colic and actual soreness in the loin.

DR. FRANCIS R. HAGNER (Washington, D. C.): I think the case which Dr. Neff reported is a very interesting one. I have often wondered, in these varices of the papillæ, what the ultimate result is in those cases that are due to some circulatory disturbance in the kidney. I think if we could watch some of those cases and see whether the patients with varices die from an arteriorenal death eventually, it would be very interesting.

I would like to say a word about uroselectan. I think uroselectan for retrograde pyelography is a very important thing. No doubt a great many men use it. We have been using it now for more than a year and the patients do not have the colic that they have with sodium iodide; they do not have the pain, and there is much less reaction from the use of uroselectan in retrograde pyelography than from the use of the old solutions.

DR. HUGH CABOT (Rochester, Minn.): The group in which I am most interested, in regard to this question of nephrostomy, is the group of bilateral stone. You probably remember that a member of this Association, Frank Watson, was one of the very early people to call attention to the possible value of nephrostomy. He had one patient, within my knowledge, who lived very happily and very comfortably for more than fifteen years after a bilateral nephrostomy for stone which recurred very rapidly, and after several operations he got to the point where nothing else was possible. I saw him only after Dr. Watson had intubed both kidneys for some years, and he carried on a very active life very comfortably.

I think we have tended perhaps to regard nephrostomy, that is, a more or less permanent nephrostomy, as so objectionable as to be very disabling. I do not think this is true. Years ago I know we regarded colostomy—permanent colostomy—as a very disabling procedure, which is not true, and I am satisfied that permanent nephrostomy may be entirely compatible with a very comfortable and very active existence.

I hope we shall get more evidence upon whether or not nephrostomy does in fact affect the rapidity and amount of re-formation of stone. A recent report by Boyd tends to show, where rapid recurrence was taking place before a nephrostomy, that in about seven years, I think, following nephrostomy it has not taken place. I believe it is quite possible that we may be able to alter the

quality, if not entirely abolish infection in these kidneys, and there is certainly a group of patients with bilateral stone who go on progressively to a very uncomfortable death, whose lives, I think, may be prolonged and their activity be sufficiently good to justify it. Many of them live for several years at least, in a condition which is not at all worth while.

The point that I wanted to bring out in regard to technic is that I have always been afraid of tearing renal tissue more than was necessary. I think there are a certain number of cases in which there will be fulminating infection which will destroy the kidney. The less damage one can do to the kidney, the better, and the technic which was suggested here seems to me to do remarkably little damage and would be to that extent desirable. I do not like to poke instruments down the kidney. I have done it many times and it seems to me a necessarily damaging method.

I hope that Dr. Randall's contribution to the problem of diet will be more successful than previous contributions to the problem of diet in stone formation.

Dr. William F. Braasch (Rochester, Minn.): I would first like to discuss briefly Dr. Hagner's paper right now because he can't come back in rebuttal. He and I have frequently had controversial opinions as to the cause of essential or idopathic hematuria. In the first place there are two groups of idiopathic hematuria. The first group is that in which there is a frank organic basis such as hematitis, which constitutes a group in itself. The second group is where we find no evidence of pathology on removal of the kidney, and it is that group which is by far in the majority. We have certainly observed a large number of patients, in that group of cases, who have been followed up for years afterwards, sometimes as long as twenty years after the diagnosis has been made, and we are fully convinced that that group of patients shows no evidence, with very few exceptions, of any nephritis later on or any cardiorenal changes. Our experience has been quite to the contrary of those which Dr. Hagner has advanced.

Dr. Roger C. Graves (Boston): Dr. Braasch, have you any like impressions regarding those patients who have showed varices, as to their ultimate outcome? Do they go on uninvolved or do

they show nephritic changes? Have those in whom you have removed kidneys and who have shown varices subsequently shown renal changes or disease?

Dr. William F. Braasch (Rochester, Minn.): No, our prognosis has been practically normal.

As regards the treatment of angioneurotic hematuria, in recent years a number of theories have been advanced, in the first place as to etiology. Let us first review our own. You remember several years ago at our Clinic we advanced the theory of blood dyscrasia as being an etiological factor and we felt that that was a clue to the possible etiology. One of our staff members, however, had his own blood examined and found he had a very low blood-platelet count and had no hematuria, so he came to the conclusion that that probably was not an etiological factor. Since then we have followed our cases and are very doubtful as to whether blood dyscrasia is an etiological factor.

In regard to treatment, not long ago Hagner suggested the use of deep X-ray therapy and we have tried that out consistently in fifteen or twenty cases but we have failed to find it of very much value. In one case it stopped the hematuria but that was the only one, so I would question very much that method of treatment.

It is a peculiar thing that in recent years we have observed in a number of cases of hematuria that we could not stop it by injecting large quantities of nitrate solution nor by any other methods. In one case we tried a sympathectomy according to the very latest theories of therapeusis and that did not stop the hematuria. In several cases we have tried the Muss operation, decapitation, and so forth, and that did not stop it. Strange as it may seem, in recent years we have found nephrectomy necessary to stop the hematuria more frequently than all the other years put together, so it really opens up a very interesting subject and you will pardon me for discussing it at length.

In regard to the intravenous urography, I question very much Dr. Randall's contention that in the case of complete absence of visualization, immediate interference is necessary. I have observed this absence of visualization where the stone has been present for months without any acute symptoms, where the operation was

done some time afterward, and where the kidney was found to be in good condition. With acute symptoms, it might be additional evidence of immediate emergency surgery, but otherwise not.

As far as Dr. Keyes' question is concerned, I referred to the absence of visualization with dye tests, for instance. It happens often that with a stone in the ureter or kidney the blue test will not make it appear at all; the red test is better, but the red test is very inaccurate. The question of leakage, and so forth, comes in all the time and that cannot be relied upon either. In other words, a decrease of phthalein to a marked extent is very common in the presence of lithiasis. I therefore think uroselectan is more accurate in the majority of cases than the dye tests in that particular condition only.

Dr. Henry O. Mertz (Indianapolis): I neglected to add, in my statement, that I did not include in the statistics the question of ureteral anastomosis either with the colon or with the duodenum. I found three instances of uretero-duodenal anastomosis. Two of these patients were operated on. In one of them there was no statement excepting that the condition had been found. There are several instances of uretero-colonic anastomoses. It is very interesting to understand how that can happen and why the condition should have developed instead of the anastomosis with the kidney itself.

SECOND DAY, JUNE 5, 1931

UNUSUAL URETERAL ANOMALY: REPORT OF TWO CASES

JOHN L. CRENSHAW, M.D.
Section on Urology, From The Mayo Clinic, Rochester, Minnesota

So much has been written in recent years on the subject of ureteral anomalies that a review of this material would be superfluous, and I have nothing to add to the knowledge of the developmental causes. The most common ureteral anomaly is duplication of one or both ureters. This anomaly occurs so frequently that if a short time should pass without one having been seen in a large urologic practice it can be reasonably assumed that the condition is being missed in cystoscopic examination, and will continue to be missed unless the possibility of an anomaly is kept in mind and actual search for it is made.

Braasch and Scholl reported that 144 cases of duplication of the ureter were diagnosed at The Mayo Clinic between 1907 and 1922. The condition was unilateral in 135 cases (94 per cent) and bilateral in nine (6 per cent). Most of these anomalies were diagnosed by cystoscopic observation of the two meatuses although a few were discovered only after a pyelogram had suggested duplication of the pelvis or in which the outline did not tally in size with the outline of the kidney in roentgenograms made without injection of the kidney. Although the foregoing data represent the frequency of the diagnosis of anomaly of the ureter before the advent of intravenous urography, the actual occurrence is much more common, and diagnoses will now be made much oftener with the more general use of the intravenous method. Not only will the number of patients with a diagnosis of duplication of the ureter be increased but the occurrence of bilateral duplication will prove much more common than was formerly believed. This is true of some other types of anomaly or early developmental defects, for example, certain types of hydronephrosis in which it was believed the good kidney was normal because the function was good. We now know, thanks to intravenous urography, that in many cases the primary etiologic

factors are present also in the other kidney. We should, therefore, be more conservative in operative procedures on the poorer kidney.

The two cases which I shall present are unusual. The condition in both was diagnosed prior to the use of intravenous urography, which was used later to corroborate the diagnosis.

Case 1.—A single woman, aged twenty-five years, registered at the clinic September 27, 1929. The patient's mother had died at the age of sixty-four years, from carcinoma of the rectum. The family history was otherwise negative. The patient had had influenza in 1918, and had had several attacks of tonsillitis. Tonsillectomy was performed in 1921, uterine suspension in 1926, appendectomy in 1928, and left nephrectomy in 1929, for infected hydronephrosis. Duplication of the ureter and pelvis on the left side had been found at operation. Cystoscopy prior to operation had revealed duplication of the right ureter. About four weeks after the operation a dull ache, accompanied by slight fever and chills, developed in the right costovertebral angle and in the right upper quadrant to the right of the umbilicus; the pain was not referred to the groin or thigh. Cystoscopic examination at that time had revealed pus from the right kidney. During the week before admission, the dull ache in the right side had been more severe, particularly when the patient was on her feet, and she feared that the right kidney might also be affected. A letter from the physician who had made the cystoscopic examination stated that there was duplication of the right ureter and that duplication of the left kidney had been found at operation for hydronephrosis.

General examination at the clinic disclosed systolic blood pressure 120 and diastolic 70; pulse 72; weight 148 pounds, and slight tenderness over the right upper quadrant of the abdomen. The specific gravity of the urine was 1.014, the reaction was acid, there was a slight trace of albumin, no sugar, and pus was graded 3 (more than 50 cells to the high-power field). The blood urea was 18 mg. in each 100 c.c. The phenolslphonphthalein return was 70 per cent in two hours. The Wassermann reaction of the blood and roentgenograms of the thorax and of the urinary tract were negative. The tonsils had been cleanly removed.

The patient was very intolerant to cystoscopic examination. Indigocarmine injected intravenously was seen coming in normal concentration from the right side of the bladder but none was seen from the left. After several attempts with intervening periods of irrigation of the bladder, two meatuses were located to the right of the median line, one in normal position and one in the edge of the sphincter. After a month of treatment the ureter, situated in the right trigone, was catheterized with difficulty and a pyelo-ureterogram showed a comparatively normal pelvis, calices, and ureter with no suggestion of duplication. There was no pus in the ureteral specimen and no reten-

tion in the pelvis. Several attempts, however, at this time failed to catheterize the second meatus situated in the right side of the sphincter and the possibility of a second kidney on the right side was considered.

February 2, 1930, the lower part of the right ureter was explored through a low median-line incision, with the idea, if it seemed advisable, of transplanting the ureter from the sphincter into a portion of the bladder where it would be relieved of the sphincteric pressure. However, a single normal ureter was found on the right just above the bladder and the exploratory incision was closed.

On subsequent careful cystoscopic examination indigocarmine was not seen to come from the meatus which was situated in the sphincter; eventually the ureter was catheterized with great difficulty and a pyeloureterogram was made. Much to my surprise, this film showed a hugely dilated ureter arising from the right and crossing the median line; it filled to its middle third in the position of a normal ureter from the left side. It would seem, therefore, that the condition which really existed primarily was duplication of the left ureter, one ureter opening in normal position in the left trigone and the other opening into the right side of the vesical sphincter and adjacent to a normal right ureteral meatus. The patient's symptoms were in all probability due to compensatory hypertrophy of the right kidney. The symptoms have subsequently largely disappeared.

Case 2.—A woman, aged twenty-nine years, registered at the clinic June 16, 1930. The patient had married at the age of twenty and had one child aged seven years. During this pregnancy the patient had noted pain on urination. This disappeared after delivery but appeared about a year later and had increased in severity for the last year. The burning pain was in the urethra just before, during, and after urination, with slight frequency, slight nocturia, and some urgency. Gross hematuria was not present. Symptoms were worse at the time of menstruation. She had had chills and fever for several days three months before admission. Mid-epigastric pain occurred occasionally for several days at a time; it came on when she was hungry and was relieved by eating. A dull frontal headache was present most of the time. She had lost about 20 pounds in weight in the last year. Several days before admission considerable pus had been found in the urine and cystoscopic examination had revealed an impassable obstruction a short distance up the right ureter.

The patient weighed 164 pounds. The systolic blood pressure was 130 and the diastolic 85. The pulse was 120, and the temperature was 100° F. at 11 A. M. Moderate pyorrhea, moderately enlarged chronically infected tonsils, a small adenoma of the right lobe of the thyroid gland, and tenderness in the right upper quadrant of the abdomen were noted. There was no tenderness of the costovertebral angle and no urethral reddening. The pelvis was normal save for moderate cystic cervicitis. The specific gravity of a catheterized specimen of urine

from the bladder was 1.014; it was acid in reaction, contained a trace of albumin, an occasional erythrocyte, and gross pyuria, but no sugar. The blood urea was 34 mg. in each 100 c.c. The Wassermann reaction of the blood and roentgenograms of the thorax, urinary tract, gall bladder, and stomach were negative. The urethra was normal. There was marked subacute granular cystitis. The right ureteral meatus was slightly gaping and slightly eroded. The left ureteral meatus was normal. The left ureter was catheterized without difficulty and microscopic examination of the specimen disclosed a large amount of pus, a stain of which was negative for the bacillus of tuberculosis. A catheter introduced into the right meatus met an obstruction 4 cm. above the meatus which was impassable to various types of catheter and to a whalebone filiform. The "feel" of this obstruction was unusual in that there was no grating and no sense of hang or constriction. A specimen of urine contained only a few pus cells. A right pyelo-ureterogram showed that the ureter bifurcated 2 cm. above the bladder, the outer segment proceeded as a normal ureter to the renal pelvis, and the inner segment in which the ureteral catheter lay ended abruptly 3 cm. above the bifurcation. The pelvis and calices were not sufficiently outlined to permit of diagnosis. The ureterogram suggested that the true ureter came off from the outer lateral wall at the bifurcation, and acting on this suggestion in a subsequent cystoscopic examination I bent the tip of a pointed ureteral catheter to almost a right angle, and feeling along the lateral wall of the ureter easily catheterized the true ureter on this and subsequent occasions. A complete right retrograde pyelo-ureterogram and an intravenous urogram with uroselectan showed the right pelvis and calices to be only slightly dilated, although the upper two-thirds of the ureter was rather markedly dilated. The inner fork of the bifurcation ended, as previously described, in a blind tube 3 cm. above the bifurcation. The left side revealed marked dilatation of pelvis and calices and moderate dilatation of the ureter. Guinea pigs were inoculated from both kidneys. Inoculations were negative from the left kidney and the pigs inoculated from the right kidney died too early to reveal conclusive data.

A final diagnosis was made of bilateral pyelonephritis, ureteritis, and cystitis with a diverticulum in the lower third of the right ureter. Most of the patient's symptoms, however, seemed attributable to cystitis; these symptoms were relieved by lavage of the bladder and pelves. The final catheterized renal urine contained only a few pus cells.

I am not prepared to name the exact embryologic mechanism in this case, that is, whether it was a true diverticulum of the ureter or an attempt at partial duplication of the right ureter.

COMMENT

I have presented these cases on account of the rarity of the ureteral anomalies rather than for their pathologic aspect, although

Case 1 demonstrates well how far wrong one can go by drawing diagnostic conclusions from incomplete cystoscopic data.

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ADVANTAGES OF URETERO-INTESTINAL ANASTOMOSIS FOLLOWING NEPHRECTOMY FOR TUBERCULOSIS IN CERTAIN CASES

A. R. STEVENS, M.D.

From the Urological Department, Bellevue Hospital, New York City

I am encouraged to draw attention to the advantages of ureteral transplantation into the bowel in dealing with certain patients who still have an intolerable urinary condition after nephrectomy for tuberculosis, because of my gratifying experience with two such personal cases so treated. Both patients were afforded immediate relief and at the end of two and one years respectively are at work, entirely comfortable and in excellent general condition.

Case 1.—(This is also Case 1 in article entitled "Pyoureter" by H. S. Jeck[3]). An Italian girl, aged fifteen, was first admitted to the hospital March 5, 1926, complaining of pain in the back and right lower abdomen of four months' duration, but especially of marked frequency of urination which had become progressively worse the past eight months. Fortunately the child was a sound sleeper and the night frequency was practically incontinence. Hematuria had been noted for one week.

Examination revealed the patient as of fair weight and not appearing very sick. General examination, including lungs, was quite negative. There was slight tenderness in both costo-vertebral angles, more on the right side; the kidneys were not palpable. The urine was turbid, contained some albumin and considerable pus and blood; but no tubercle bacilli were found. Hemoglobin was 75 per cent; leukocytes, 8,000.

Cystoscopy showed the bladder capacity was only 1.5 ounces. Urine was very cloudy. The bladder showed marked general inflammation and bled easily. After several abortive attempts, the right ureter was finally catheterized and very turbid urine was obtained; this contained much pus but no tubercle bacilli were found in the stained slide; the urea percentage was 0.3, and indigo-carmine given intravenously appeared in a trace only, after twenty minutes. The left ureter was not catheterized, but urine obtained from the bladder after thorough irrigation contained no pus; its urea percentage was 0.5 and indigocarmine appeared in seven minutes in deep concentration. A right pyelogram showed a non-rotated kidney with dilated calices, some with an irregular contour indicating a destructive process.

On March 29, 1926, right nephrectomy under general anesthesia was done. The ureter was very indurated and nearly 2 cm. in diameter. It was cut across near the pelvis, as I thought the patient's condition did not permit complete ureterectomy. The kidney was of normal size, and contained many small abscesses; the histological report was tuberculosis.

On April 22, phenolsulphonephthalein output (after intramuscular injection) was 15 and 10 per cent for the first two hours. Operative recovery was satisfactory but the urinary frequency continued. Cystoscopy revealed general cystitis and ulcerations about the right ureteral orifice. Two applications of 20 per cent acid nitrate of mercury were made to these ulcers. The patient was discharged from the hospital, May 22.

She was re-admitted October 6, 1926, for five weeks, as the urinary frequency had become even more marked, often every five to ten minutes, and there was occasional hematuria. Cystoscopy showed tubercles about the right ureteral orifice and general cystitis. The left ureter was catheterized and clear urine obtained; microscopically there were only a few scattered leukocytes and no tubercle bacilli. The patient was discharged to a tuberculosis sanitarium.

She was re-admitted February 9, 1927, with no improvement of the urinary status. The cystoscopy picture was about the same and the bladder capacity was 0.5 ounce. Remembering the condition of the ureter as found at the first operation, I suspected that this might be a fundamental cause of trouble, and on February 24 removed the remainder of the right ureter down to the bladder, easily drawing it under the broad ligament. I was amazed to find that the ureter had changed markedly in size and consistence; it was soft and pliable and no larger than a lead pencil. During this procedure the peritoneal cavity was entered, several ounces of clear fluid evacuated, and several loops of bowel studded with tubercles were noted. The bladder was palpated, was small and its wall seemed to be 7 or 8 mm. thick. The ureter showed microscopic evidence of tuberculosis. The convalescence was uneventful but the urinary condition was not helped by this operation. The patient was discharged March 27 to a sanitarium for tuberculosis. Bladder irrigations of some sort were tried with no relief.

Cystoscopy on May 16, 1927, showed general cystitis with some small ulcers on the left side of the bladder; two typical tubercles were seen. The bladder capacity was still small. Ureteral transplantation was considered at this time, but fearing extensive intra-peritoneal adhesions, I advised further waiting.

In December, 1928, the patient was virtually incontinent day and night. Fortunately this did not seem to interfere with sleep and she held her weight. The bladder capacity was 1.5 ounces and cystoscopy showed some improvement in the appearance of the mucosa in that

there were no ulcerations or tubercles. Indigo-carmine given intravenously appeared in ten minutes distinctly but not of deep color.

The patient's fifth admission to hospital was on May 21, 1929. The situation had been carefully weighed. The girl was one of eight children living with the two parents in a four room flat. Her bed was soaked with urine every night and pads were worn by day, and she was unable to mingle with friends. She and her mother were quite willing to take any risk involved in a procedure which offered hope of relief.

On May 24, 1929, the left ureter was transplanted into the upper rectum through a left rectus incision extending from the umbilicus to the pubis. The rectum had been thoroughly irrigated just prior to operation. The work was begun under spinal anesthesia but general anesthesia was required later. On opening the peritoneal cavity, it was a great relief to find but few adhesions and no tubercles present. There was no evidence of tuberculosis of the fallopian tubes. The ureter was located at the junction of the internal and external iliac arteries and followed to the bladder. The overlying peritoneum was incised and the ureter cut across near the bladder with a carbolized knife; the lower end was tied and the upper clamped. The ureter was uniformly dilated, about 8 mm. in diameter. The small intestines were held in the upper abdomen by gauze pads. The anastomosis of ureter with large bowel followed closely the earlier technic of Coffey, no catheter being used in the ureter. The musculature of the bowel was dissected well back from the mucosa, affording ample space for the large ureter. This was held in place by the suture in the end of the ureter, brought out through the bowel wall about 1.5 cm. below the opening made in the mucosa to admit the ureter; its position was further fixed by including a little of the ureteral wall in the lowest of the five Lembert sutures of fine chromic gut closing the muscle and serosa over the ureter. A few reinforcing sutures were employed, and the site of the fixation suture from the end of the ureter was similarly covered. The posterior peritoneum was carefully sutured and the abdominal wall closed in the usual manner, with a cigarette drain to the site of anastomosis. Care was employed that the ureter should follow an easy course to the bowel without angulation or any tension. A tube was left in the rectum four or five days after operation.

The ureter seemed dilated with urine at the end of the operation. I feared the closure of the bowel over the ureter may have been made too tight, and was prepared to do nephrostomy later. Urine came from the rectum during the night after operation, however, and 11 ounces were recovered the next day, and 40 ounces during the succeeding twenty-four hours. The temperature touched 102 the first postoperative day, but subsequently did not rise over 100. At no time was there any tenderness over the kidney. The patient made an excellent recovery and was discharged from the hospital nineteen days after

operation with the wound healed. She had good rectal control, holding urine two to three hours and not wetting the bed at night.

Two months after operation the intramuscular phthalein test was 10 and 5 per cent, collections being made at the end of one hour and ten

Fig. 1. Case 1. Intravenous uroselectan urogram, thirteen months after implantation of left ureter in large bowel. This operation was performed three years after right nephrectomy for tuberculosis.

minutes and two hours and ten minutes. Six months after operation the phthalein test was the same, and the patient had gained 15 pounds.

A year after operation she looked and felt very well. Bowels usually moved easily, but the patient occasionally took a little mineral oil. She rarely got up at night to urinate and held urine from two to four

hours by day. There was no wetting of bed or clothes. Intravenous uroselectan urograms were made (Fig. 1) and show some dilatation of the ureter, probably more than existed at the time of operation. Eighteen months after operation, the phthalein output was 7 and 20 per cent for two hours.

Two years after operation (May 17, 1931), the patient was cheerful and doing daily clerical work. She had no complaints and was urinating every two to three hours when standing but held urine four hours when sitting. She frequently sleeps all night without interruption and never gets up to urinate more than once. When exercising strenuously she occasionally leaks a little urine, otherwise the control is perfect. Intravenous phthalein test shows 5, 10, 10, and 5 per cent for the first four half-hour periods. Intramuscular test was done for comparison with earlier reports; it was 10 and 15 per cent for two one-hour periods. These certainly show no diminishing renal function, but rather an improvement since operation.

Case 2.—An Italian man, aged thirty-six, was admitted to hospital March 17, 1930, complaining of frequency of urination and dysuria. Two years earlier his left kidney had been removed for tuberculosis. But the urinary distress really became worse and for five months after operation there was also occasional hematuria. At time of admission, urination was at intervals varying from fifteen minutes to one hour. There was almost a constant desire to empty the bladder, and the patient frequently bent double with straining and pain during the act.

The family history was negative for tuberculosis, and the patient's own past history was irrelevant except as stated.

Examination revealed a small, thin, under-nourished man, weighing 97 pounds, who appeared worn out from loss of sleep. We could find no evidence of an active tuberculous process anywhere outside the urinary tract. Radiograms of the chest were negative and examination of abdomen and genital tract was likewise negative. The urine showed a trace of albumin and much pus. No tubercle bacilli were found on three microscopic examinations. The Wassermann test was negative. Six blood examinations showed N.P.N. varying between 33 and 42 mg. per 100 c.c. of blood, and creatinin between 1.6 and 2.2. Phthalein test (intramuscular injection) before operation, varied between 15 and 30 per cent and 35 and 20 per cent for two hours. This certainly precluded any marked tuberculosis of the remaining kidney.

Cystoscopy showed the bladder capacity was not over 2 ounces. There was general cystitis with a few small ulcerations on the right posterior wall. The right ureteral orifice was large but would admit no catheter over 2 cm.

The patient was given six weeks' treatment of the bladder, trying irrigations and also phenol instillations. These seemed to lengthen the average intervals between urinations, but the longest was never over one hour. The pain continued to be severe, however. The tem-

perature was elevated at times, but an afebrile period was chosen for operation, after two postponements.

On April 29, 1930, transplantation of the right ureter into the upper rectum was done through a midline incision, under spinal anesthesia. The technic employed was virtually the same as in the first case. The ureter was soon found, and proved to be nearly 2 cm. in diameter. The large bowel was not over 3 cm. in diameter, so that the job looked formidable. After the ureter was cut across and allowed to empty, however, its size diminished markedly. The urine collected was later examined and it contained only an occasional leukocyte; no tubercle bacilli were found. The muscular layer of the bowel wall was dissected widely to make room for the large ureter. Two of the Lembert sutures grasped a small bit of ureteral wall, care being taken to avoid blood vessels. A second layer of Lembert sutures was placed over the first layer and over the ligature in the bowel wall, coming from the end of the ureter. Care was exercised that the ureter should follow an easy course without angulation or tension. The posterior peritoneum was carefully sutured, and the abdomen closed without drainage. As in the other case, a tube was left in the rectum for about five days.

Urine came from the rectum the day after operation and there was a good output daily thereafter. Three days after operation the N.P.N. rose to 48, but soon dropped to normal. The temperature reached 103 on the third postoperative day, but was not above 100 afterwards. In two weeks, the patient was passing urine every two or three hours, about 7 ounces at a time. There was no tenderness noted in the kidney region at any time. Urograms were made after giving uroselectan intravenously, nineteen days after operation. These showed dilatation of the ureter (Fig. 2), about as would be expected from the operative findings. Twenty-two days after operation the patient left the hospital, with wound healed and a gain of 4 pounds in weight.

Six months later, he weighed 115 pounds (a gain of 18 pounds since operation), had no discomforts and controlled the rectum day and night. He did not drink much water and hence emptied his rectum only four times in twenty-four hours. He would notice a little pain for a few minutes occasionally, in the right costo-vertebral angle, "on cloudy days." A year after operation (May 17, 1931), he reported that he could sleep continuously for seven to eight hours, and urinated by day only once in five to six hours, always having good control. He was feeling well and working every day as a clerk. His weight was 116 pounds. Phthalein test (intravenous) was 5, 10, 5 and 10 per cent for the four succeeding half-hour intervals.

It is a matter of common knowledge amongst urologists that the change in urinary symptoms following nephrectomy for tuberculosis cannot be predicted. If frequency has been of short duration, it may cease quickly. But with a long history and tuberculous in-

volvement of the bladder, no improvement may be noted during the stay in hospital. In some instances, with proper and prolonged hygienic care including heliotherapy, the patient may become entirely comfortable in time. Indeed, such care should be urged upon all patients following any surgical operation for tuberculosis. Those

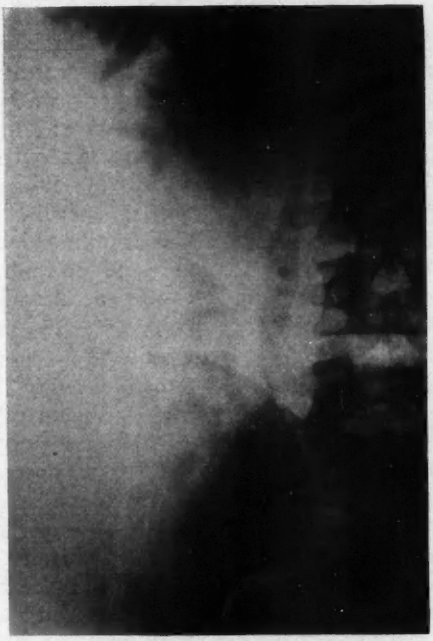

Fig. 2. Case 2. Intravenous uroselectan urogram, three weeks after implantation of right ureter in large bowel. This operation was performed three years after left nephrectomy for tuberculosis, by another surgeon.

individuals with continued bladder symptoms after nephrectomy should also be given the benefit of instillations—bichloride of mercury, phenol, medicated oils like gomenol, and methylene blue all have their advocates. If ulcerations exist, treatment with fulguration or caustics is often useful. Urinary symptoms may be prolonged because of the persistence of a secondary infection or the

co-existence of lesions of the ureter or prostate and seminal vesicles. When all of these resources have been exhausted, distressing symptoms may still remain. To this unhappy and pitiable group of patients, with frequent and painful urination, life is scarcely worth while. They will obtain relief only through some operative procedure aimed at sidetracking the urine and thus putting the bladder at rest. Suprapubic drainage gives temporary relief only, if at all. Nephrostomy seems justifiable only as a preliminary measure to improve the kidney function and reduce the degree of hydronephrosis preliminary to diversion of the urinary stream by some operation on the ureter. Ultimately, implantation of the ureter to the skin or in the intestinal tract seems to offer the only possibility of relief.

The decision between these two courses depends first on a comparison of the two operations for diverting the urinary stream, as done for any and many reasons; and secondly, on a consideration of what is best for tuberculosis cases in general and for a specific patient in particular.

The skin operation was decidedly the less risky until recent years, when rapid strides have been made in improving the technic of anastomosis of the ureter and the bowel. Supported by much experimental work, clinicians have been able to report excellent results. Should the immediate mortality from this operation be shown in the future to be but little greater than that to be expected from implantation of the ureter in the skin, and the expectancy of life as favorable (and these are possibilities), there is no question that the bowel operation will become the one of choice in most cases. The absence of urinous odors about the individual and of an apparatus needing continuous care, together with the greater comfort and greater freedom of action following the bowel operation, are the chief arguments coming to mind.

At present, in the hands of most surgeons, anastomosis of the ureter to the skin has less immediate mortality than anastomosis to the bowel, and is undoubtedly the method of choice in debilitated individuals. Papin[9] reported that a search of the literature to 1925 showed 50 per cent mortality for all ureteral transplants to the large bowel. Yet skilled surgeons with large opportunities for this type of work, such as Coffey, C. H. Mayo and Lower, have shown what may be expected of the newer methods of uretero-intestinal

anastomosis. Coffey's report[1] of twenty consecutive operative cases, many with double implants at one operation, with only one hospital death, is particularly encouraging.

The late results of transplantation of the ureter to either skin or bowel seem to be largely dependent on the presence or absence of obstruction and infection. Both may be encountered after either type of operation. Obstruction following anastomosis to the skin is controllable by the use of a permanent ureteral catheter or regular dilatation or incision. Whereas obstruction at the end of a ureter implanted in the bowel is out of reach, dependence is entirely on the development and execution of good technic. One naturally supposes that renal infection would more frequently follow implantation of the ureter in the bacteria-infected gut than in the relatively clean skin. Yet only experience will answer this question. McKenna[6] has shown an absence of infection and no decrease of function in the kidneys of experimental animals, more than a year after the ureter was transplanted into the bowel by Coffey's method. Also, let us not forget the natural history of exstrophy cases,[14] that over 50 per cent of them die under ten years, and but 30 per cent reach the twentieth year; and in a large percentage of these deaths infection is the cause.

While the length of life following transplantation of the ureter to the skin is presumably as favorable as that following transplantation to the bowel, I have not encountered, in a perusal of recent publications, a case in which the patient had lived more than six years after the skin implantation, at the time of the report. No attempt has been made as yet to follow up this point in the literature. On the other hand, Turner[17] reported patients living up to fifteen years following ureteral transplantations to the bowel after the manner of Stiles (no attempt to construct a mucous membrane valve); and I know of two patients who lived at least seventeen years, one after a Maydl[14] and one after a Bergenhem[15] operation for exstrophy.

It seems to be generally conceded, and is supported by much experimental work, notably that of Sweet and Stewart,[16] that the lymphatics of the ureter represent the chief route followed by infections from the bowel to the kidney, especially in the early portion of the trip; and operations have been devised to protect the end of the ureter from bowel contamination. It would seem that sealing by mild cautery coagulation of the cut end of the ureter

should serve this purpose. But I have not yet tried this technic. Coffey and others have advocated the use of an indwelling ureteral catheter during the early days after operation, believing that fewer kidney infections follow, and that temporary obstruction by edema is thereby avoided. The ligature holding the catheter in the ureter probably closes the ureteral lymphatics to infection temporarily, and some sealing of the free end of the ureter, left after the sloughing distal to the ligature, is caused by the traumatic pressure of the ligature. On general principles, I have not liked this use of catheters in the ureter as the presence of a foreign body in any part of the urinary tract promotes infection. But many operators have followed Coffey's lead in this matter, and the experimental work of Sisk, Wear and O'Brien[13] adds evidence in favor of the catheter. Moreover, I have had no trouble with temporary obstruction after opration, in a small experience. Five ureters have been implanted into the bowel by the Coffey method in four patients, and urine has appeared in the rectum in all cases within twelve or fifteen hours, and an abundant amount expelled in the next twenty-four hours. In only one case was a catheter used in the ureter, and curiously the corresponding kidney was the only one in this series which was tender subsequent to operation. C. H. Mayo[8] reported in February, 1930, that he still used no catheter in doing uretero-intestinal anastomoses, but operates on but one ureter at a time.

As for the results in tuberculosis cases in the recent literature, Rosenkranz[11, 12] reported two patients alive and well two and four years after ureteral transplantation in the skin (done subsequent to nephrectomy for tuberculosis); and one that died in two weeks. He felt the latter case represented an error of judgment in that the patient was weak and probably had abscesses in his kidney. Mathé[7] had two similar cases, one traced for seven months. Keyes[4] transplanted single ureters to the skin in two patients who had previously undergone nephrectomy, and they were comfortable four and five years later. He transplanted both ureters in one case of bilateral renal tuberculosis, and the patient was known to be living two years later. Papin[10] reported thirteen such transplants of ureters in tuberculosis, one patient being apparently well six years later.

Hinman[2] transplanted a ureter to the bowel in four patients subsequent to nephrectomy for tuberculosis. One died four and a half

years later from anuria and toxemia due to obstruction by a calculus in the upper ureter; one died a year later from pneumonia; another was living two years and two months after operation; and the fourth died twenty-three days after operation from miliary tuberculosis. Coffey[1] included in his report of November, 1929, two similar cases, the patients living a few months after operation. Kinloch and Drexler[5] published one similar case, the patient living six months after operation. Walters and Wright[18] included in a report of operations on single kidneys and ureters, two cases of ureteral transplantation to the bowel subsequent to nephrectomy of the other side for tuberculosis, both of which patients died; these were described as having had "irreparable" disease of the kidneys. Evidently some operations in both groups have been undertaken with misgivings in very sick patients, with the hope of relieving an intolerable condition.

It seems clear that at the present time there is not sufficient evidence available to permit a final conclusion concerning the immediate risks and ultimate prospects of life following the implantation of a single ureter to the skin or in the bowel. But the degree of comfort experienced after operation is certainly in favor of the latter procedure.

My present attitude is that all patients who still have urinary distress after nephrectomy for tuberculosis, should have both general and local treatment for a long time before the surgeon is justified in concluding that Nature will not afford relief. But when that decision is reached, some type of exclusion of the bladder must be considered. Debilitated persons and those whose remaining kidney is known to be tuberculous, should be offered transplantation of the ureter to the skin of the iliac region. I should not feel justified in transplanting to the bowel a ureter which is discharging tubercle bacilli. Those patients in better general condition whose kidney has fair function and cannot be proved tuberculous, will derive much more comfort and greater satisfaction from uretero-intestinal anastomosis.

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METASTATIC GROWTHS OF THE URETER

A BRIEF REVIEW OF THE LITERATURE, AND A REPORT OF THREE CASES

DAVID W. MacKENZIE, M.D., and MAX RATNER, M.D.

From the Department of Urology, Royal Victoria Hospital, Montreal

Pathological lesions that are of rare occurrence, and that are usually diagnosed at the autopsy table, or in the operating room, always stimulate considerable interest and discussion. Metastatic growths of the ureter belong to this class and lately we have encountered, personally, such a condition. The subject has inspired us to review the literature and collect other similar cases that have been encountered at the Royal Victoria Hospital, Montreal.

New growths of the ureter, whether primary or metastatic, are extremely rare occurrences; the former appears to be the more common of the two. Although there are reported only fifty-nine cases of primary growths of the ureter, yet an appreciable amount of literature has been written on the subject. On the other hand, very little has been published on metastatic growths of that organ. Up to December, 1930, only eight authentic cases could be found in the current literature.

It is of extreme importance to emphasize, at the start, that under the heading of metastatic growths of the ureter are included those lesions only that have been proven definitely to be the result of metastases conveyed to the ureter by lymphatics or blood vessels. Secondary growths of the ureter that are due to the direct extension of tumors of adjacent organs such as uterus, bladder, kidney, and so forth, are not true metastases, and are not included, therefore, in this class. Moreover, in order to prove that a secondary growth is a true metastatic one, malignant cells must be demonstrated in the perivascular lymphatic spaces or blood vessels of the ureter.

When one reviews the anatomy of the pelvis one finds that there is an abundant communication between the lymphatics of the pelvic organs and the ureters. This relationship is particularly striking in the cases of lymph vessels of the bladder and ureters. Despite these facts, metastatic growths of the ureter from tumors of the uterus,

bladder or prostate are very uncommon findings. On the other hand, metastases from growths of these pelvic organs are frequently encountered in the lungs, liver, kidneys, bones, and other organs and tissues. Why there is present this rather specific peculiarity of the ureters is difficult to understand. Robinson[5] claims that the lymph drainage of the lower portion of the ureters is downwards. That may help to explain the rarity of ureteral metastases.

The first authentic case of a metastatic growth of the ureter was reported by Giordano and Bumpus[3] in 1922. The patient had a carcinoma of the prostate which metastasized to the left ureter, left renal pelvis, lungs and left kidney. They were able to demonstrate cancer cells in the blood vessels of the lungs and kidney and were of the opinion that the metastases to the ureter were conveyed by the blood stream.

Thomas and Regnier[6] reported another case in 1924. The metastatic growth was secondary to a primary neoplasm of the bladder. Metastases were also demonstrated in the lymph glands, liver and psoas muscle.

In 1925, Carson[1] added three more cases to the literature. The first case was that of a man with a carcinoma of the bladder which metastasized to both ureters, prostate, mesenteric lymph nodes, lumbar vertebræ and liver. Patient number two had an adenocarcinoma of the prostate with metastases to the right ureter, bladder, seminal vesicles, vasa, right kidney, lungs, fifth lumbar vertebra and lymph nodes. The third patient was a female. She had a squamous cell carcinoma of the cervix which metastasized to the right ureter, liver, and mesenteric lymph glands. In each of the above cases microscopic examination revealed cancer cells in the perivascular lymphatic spaces, thus proving beyond doubt that the growths in the ureters were true metastatic ones.

In 1927, Carson[2] reported two additional cases. Patient number one was a male with a carcinoma of the prostate which metastasized to the right ureter, bladder, seminal vesicles, lumbar vertebræ and mesenteric lymph nodes. The second case was also that of a carcinoma of the prostate with metastases in the right ureter, bladder, seminal vesicles, right kidney pelvis, lungs and lymph nodes. The author was able to demonstrate very readily cancer cells in the perivascular lymphatic spaces of the affected ureters.

Rathbun,[4] in 1929, described a single case. The patient, a male,

had a radical operation for a scirrhus carcinoma of the left breast in 1924. He remained well until 1927, when he began to pass blood in the urine. Following cystoscopy a provisional diagnosis of a left renal tumor was made. A nephrectomy with partial ureterectomy was then performed. The pathological report was that of a metastatic carcinoma of the ureter, secondary to the carcinoma of the breast. The author unfortunately did not mention in his report the manner in which the growth of the ureter occurred. The tumor undoubtedly was a true metastatic one, but whether the metastases were conveyed by the lymphatics or blood vessels is a question.

We have carefully reviewed all the cases with lesions of the ureter that have been encountered in the departments of Urology and Pathology at the Royal Victoria Hospital, Montreal. Amongst them we have been able to find three cases of metastatic growths, thus making a total of eleven authentic cases. We venture to state that the condition is more common than the literature leads one to suppose. Furthermore, we are of the opinion that a number of the so-called primary carcinomas of the ureter are probably true metastatic growths.

Of the three cases that we are reporting one is of a woman, and two are men. The woman was thirty-four years of age and the men forty-five and sixty-one years of age, respectively. Both the male patients came to autopsy, and the diagnosis was made on the post-mortem table. The female patient is still alive. The diagnosis in her case was made at operation.

Case 1.—J. E., colored, male, aged forty-five years, was admitted to the Medical Service of the Royal Victoria Hospital on December 19, 1922, complaining of shortness of breath, palpitation, swelling of the legs, cough, bloody expectoration and slight nocturnal frequency.

The history dated back one year, when he first noticed shortness of breath on exertion. This symptom gradually increased in severity and was soon accompanied by palpitation and swelling of the legs. Cough started six months prior to admission and was associated with expectoration, which at times was blood tinged. For about one year the patient had noticed a slight nocturnal frequency of two to three times —no day frequency, or any other urinary symptoms.

He had gonorrhea and syphilis in 1902, and following treatment for both conditions was told that he was cured.

The patient's wife had one pregnancy which ended in a miscarriage at the fifth month. There have been no other pregnancies.

On admission the patient was dyspneic, drowsy and looked very ill.

There was definite evidence of recent loss of weight. There was puffiness of both eyes and pitting edema of ankles and feet.

The heart was enlarged to the left and there was present a loud apical systolic murmur which was transmitted to the axilla. The aortic arch seemed wider to percussion. The blood pressure was 190/96.

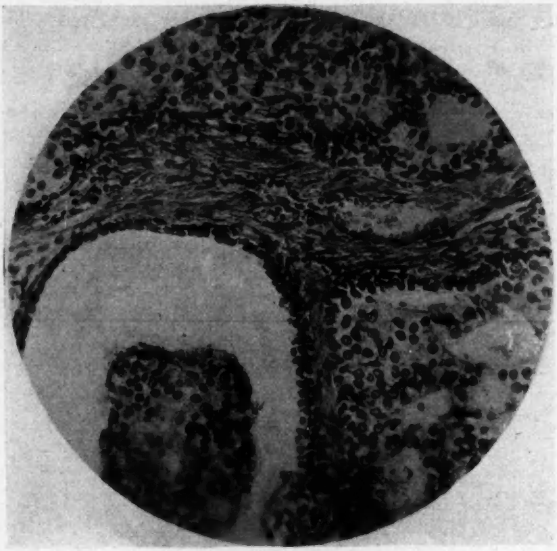

Fig. 1. Case 1. Photomicrograph of an adenocarcinoma of the prostate. Note the acini filled with large pale staining epithelial cells which have dark staining round or oval nuclei.

The lungs showed dullness over both bases with increased vocal fremitus, and the presence of many moist râles.

The liver was enlarged and the lower edge was felt two finger breadths below the costal margin.

The epitrochlear glands on both sides were readily palpated.

The findings in the genito-urinary tract were negative except for a small, smooth, but rather firm prostate.

Laboratory findings were as follows:

Urine was hazy, straw colored, acid, 1.015; albumin, +; sugar, 0; acetone, 0; diacetic, 0. White blood cells and red blood cells were

scattered. There were amorphous urates and epithelial cells. No casts were seen.

Blood count showed: red blood cells, 3,010,000; white blood cells, 14,200; hemoglobin (Sahli), 70 per cent; neutrophils, 82.0 per cent; eosinophils, 3.0 per cent; basophils, 0.5 per cent; lymphocytes, 10.0 per cent; large mononuclears, 3.5 per cent; transitional, 1.0

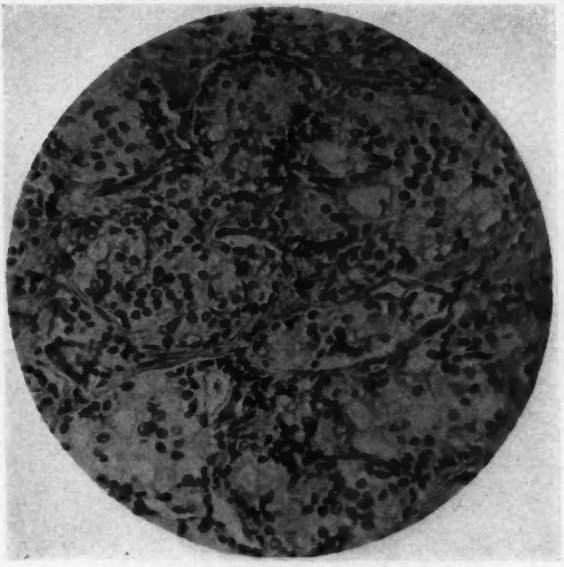

Fig. 2. Case 1. Photomicrograph of a metastatic growth of the left ureter secondary to an adenocarcinoma of the prostate. Note the large pale staining epithelial cells with round or oval nuclei. The cells are similar to those found in the growth of the prostate.

per cent. Blood chemistry showed: urea, 2.67 grams per liter; urea nitrogen, 134.0 milligrams per 100 c.c.; creatinine, 2.34 milligrams per 100 c.c.; uric acid, 15.3 milligrams per 100 c.c. Blood Wassermann test was negative. Clinical diagnosis was: (1) Chronic myocarditis with decompensation; (2) chronic nephritis, and (3) aortitis.

The patient was in the hospital about forty-eight hours and then died. An autopsy was performed.

Anatomical examination revealed adenocarcinoma of the prostate with metastases in the ureters, lungs, pleural, abdominal and medi-

astinal lymph glands; also pyonephrosis bilateral, hypertrophy of the heart, arteriosclerosis, dilatation of the first part of aorta.

Sections of the prostate showed a very diffuse overgrowth of glandular loops replacing a great part of the normal prostatic tissue. The loops showed a very marked increase of their lining epithelium. In a great many places large acini were practically filled with growth.

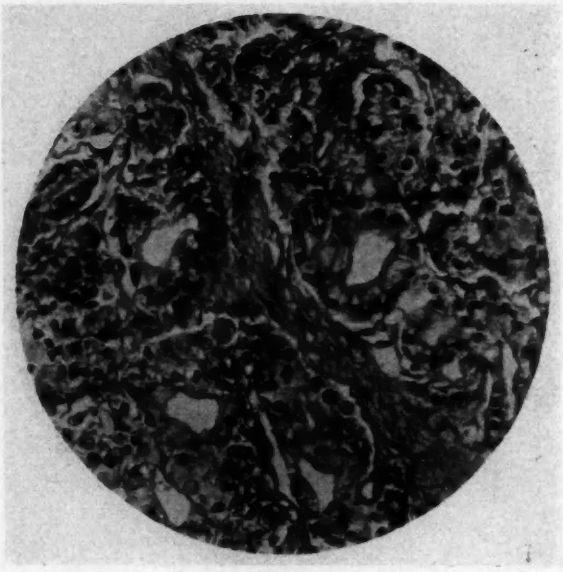

Fig. 3. Case 1. Photomicrograph of a metastatic growth of the right ureter secondary to an adenocarcinoma of the prostate. Similar picture as Figure 2 (higher power).

The cells were large, pale staining with deep staining round or oval nuclei. In parts the fibrous stroma of the prostate was infiltrated by small groups of these cells arranged in irregular nests; the larger the nests the more definitely glandular formation was seen. Diagnosis was adenocarcinoma of the prostate (Fig. 1).

The left ureter was considerably dilated in the upper part and was almost obliterated in parts in the lower half. On opening the lower half the wall showed very irregular thickenings. The right ureter showed a pedunculated mass the size of a green pea about its middle. For about two centimeters below this the ureter was free. The lumen was then blocked by a more irregular, larger mass which did not appear pedunculated. This extended for two to three centimeters.

Microscopic examination showed the growth to be firmly attached to and growing out from the ureteral walls, which showed invasion of all their coats by the carcinomatous growth (Figs. 2 and 3). Cancer cells could easily be demonstrated in the perivascular lymphatic spaces of both ureters (Fig. 4). Diagnosis was metastatic adenocarcinoma of both ureters.

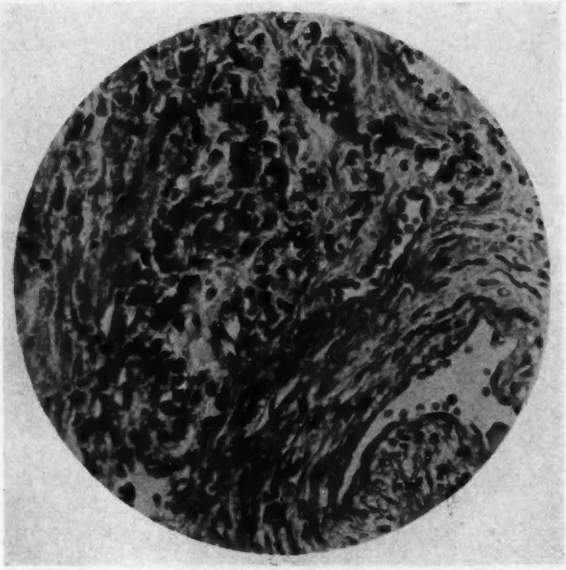

Fig. 4. Case 1. Photomicrograph showing the perivascular lymphatic invasion of the left ureter by cancer cells secondary to an adenocarcinoma of the prostate.

DISCUSSION

This case was a most interesting one. Although the patient died from a carcinoma of the prostate with multiple metastases, yet the clinical picture was that of cardiac failure and renal insufficiency. Except for the slight nocturnal frequency and a smooth, firm prostate there was nothing to indicate a carcinomatous lesion of either the prostate or ureters. The partial obstruction of the lumen of each ureter resulting from the metastatic growth undoubtedly played a major part in the formation of the bilateral pyonephrosis.

Cancer cells were easily demonstrated in the perivascular lymphatic spaces of the ureters, thus proving the metastatic character of the growth.

Case 2.—P. R., male, aged sixty-one years, was admitted to the Surgical Department in November, 1927, complaining of pain in the epigastrium, belching of gas, constipation and vomiting.

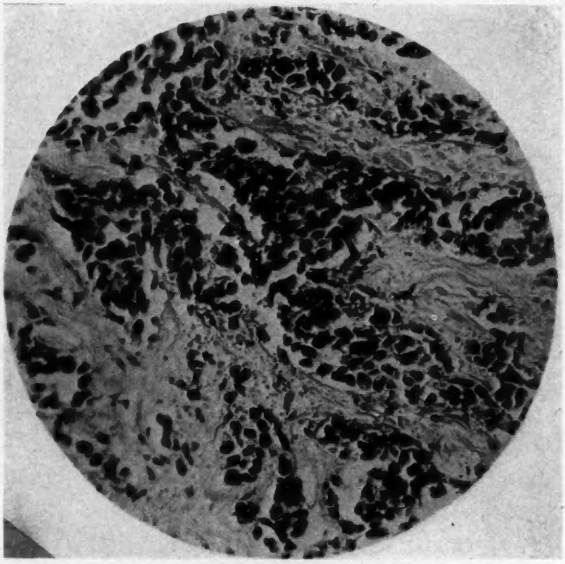

Fig. 5. Case 2. Photomicrograph of an adenocarcinoma of the stomach. Note the immature glandular epithelial cells forming irregular small acini and columns. There is also present a diffuse fibroplastic stroma.

The history dated back to February, 1927, when the patient began to be troubled with the above symptoms. The vomiting was not a constant symptom. There were no symptoms referable to the genito-urinary tract. Personal and family history was irrelevant.

The general physical examination was essentially negative.

Laboratory findings were as follows: Urine was cloudy, straw colored, acid, 1.015; albumin, xx; sugar, 0; pus, xx; amorphous urates, x. Epithelial cells were present. There were no casts. Blood count showed: Red blood cells, 4,600,000; white blood cells, 7,400;

hemoglobin, 70 per cent (Sahli). Blood Wassermann test was negative. Barium series revealed a lesion of the body of the stomach, probably ulcer, but a carcinoma could not be ruled out.

A laparotomy was performed and an inoperable carcinoma of the lesser curvature of the stomach was found. As the stomach was still emptying, nothing further was done at that time. The patient was discharged on November 30, 1927.

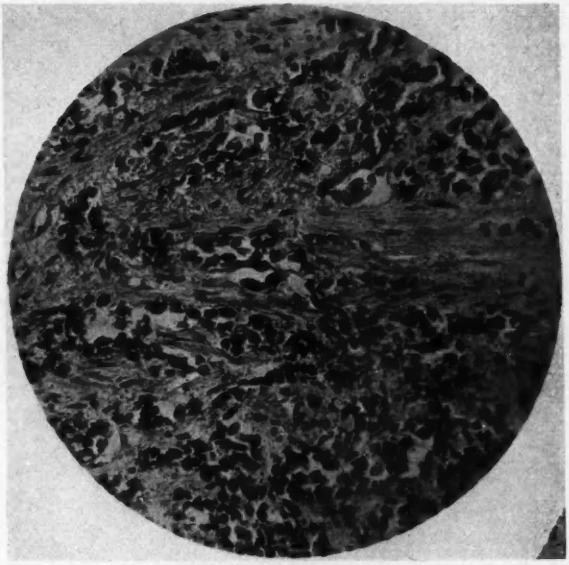

Fig. 6. Case 2. Photomicrograph of a metastatic growth of the right ureter secondary to an adenocarcinoma of the stomach. Note the nests of immature glandular epithelial cells which are similar to those found in the growth of the stomach.

In June, 1928, the patient returned. He was now vomiting everything he ate. A jejunostomy was therefore performed. The patient died two months later. An autopsy was granted.

Anatomical examination revealed adenocarcinoma scirrhus of the stomach with metastases in the right ureter and ileum; also pyonephrosis right, myocarditis, hydrothorax, fibromyoma prostate, and passive hyperemia of the liver and lungs.

Sections of the stomach showed a marked thickening of the mucosa

due to a diffuse proliferation of immature glandular epithelial cells. These cells formed irregular small acini and columns. There was a diffuse fibroblastic stroma proliferation, most marked in the submucosa. The muscularis appeared thickened. Small nests of cancer cells could be seen infiltrating through all the coats and were always associated with a diffuse fibroblastic stroma which in some areas was mature, showing extensive fibrous tissue thickening (Fig. 5). Diagnosis was adenocarcinoma scirrhus of the stomach.

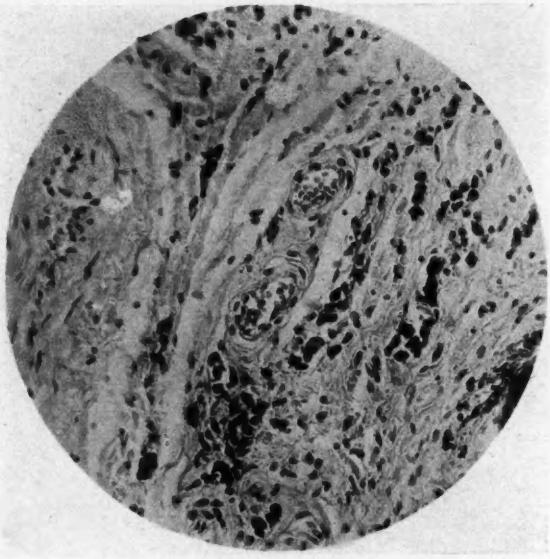

Fig. 7. Case 2. Photomicrograph showing the definite perivascular lymphatic invasion by the cancer cells in a metastatic growth of the right ureter secondary to an adenocarcinoma of the stomach.

Examination of the right ureter showed the upper half to be moderately dilated and filled with thick purulent material. This surface was red and finely granular. There were no definite masses in the lumen. Microscopic examination revealed that the muscular coats were infiltrated with small nests of immature glandular epithelial cells similar to those found in the stomach. The mucosa was intact. Fibrous stroma was abundant (Fig. 6). Cancer cells also invaded the

perivascular lymphatic spaces (Fig. 7). Diagnosis was metastatic adenocarcinoma scirrhus of the right ureter.

DISCUSSION

Although this patient had a definite metastatic growth of the ureter yet there were no subjective symptoms referable to the genito-urinary tract. The urine did show a great deal of pus, which

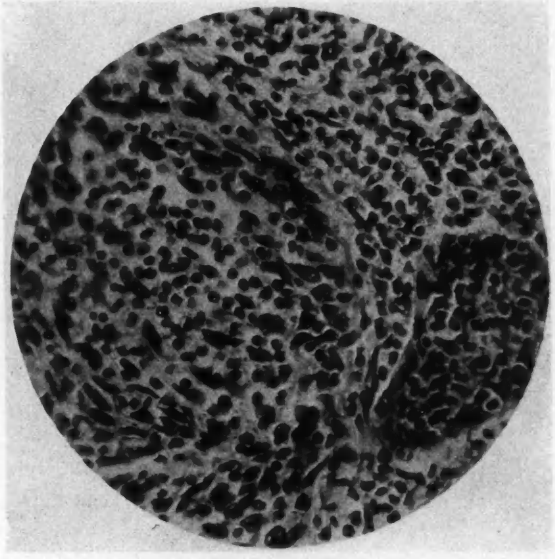

Fig. 8. Case 3. Photomicrograph of a carcinoma of the cervix. Note the dense round cell infiltration in which are nests of immature epithelial cells. Note also the presence of many eosinophiles.

explained the right pyonephrosis. Here too the growth in the ureter was undoubtedly the cause of the destroyed right kidney. The finding of cancer cells in the perivascular lymph spaces definitely proved that the growth was a true metastatic one.

Case 3.—N. B., female, aged thirty-four years, was admitted to the Gynecological Service of the Royal Victoria Hospital on August 26, 1929, complaining of pain in the left side of the abdomen, brownish vaginal discharge and bleeding at times.

These symptoms first began in July, 1929, and gradually became more marked.

The patient was married, and had had three normal pregnancies. Family history was negative.

The general physical examination was negative except for a lesion

Fig. 9. Case 3. Photograph of a left pyeloureterogram, showing a definite constriction of the ureter opposite the junction of the fourth and fifth lumbar vertebræ. Note also the dilatation of the ureter above the obstruction.

found in the anterior lip of the cervix. A portion of the lesion was removed for pathological examination.

Sections showed muscle and connective tissue with an overlying epithelium. The greater part of this tissue was replaced by a dense round cell infiltration in which were nests of embryonic epithelial cells.

Numerous mitotic figures were seen. There were also present many eosinophiles. The picture was that of a diffuse infiltrating squamous carcinoma of low maturity (Fig. 8).

The patient was given a course of radium and was kept under observation. The last pelvic examination, in September, 1930, did not reveal any evidence of recurrence of the growth.

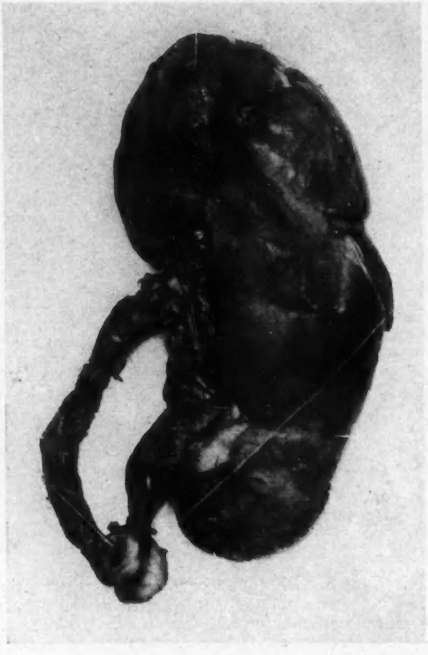

Fig. 10. Case 3. Photograph showing a metastatic growth at the point of junction of two ureters. The growth was secondary to a carcinoma of the cervix.

On September 3, 1930, the patient was admitted to the Urological Service of the hospital, complaining of frequency of urination, pain in the left loin radiating downward and forward to the left lower quadrant of the abdomen, anorexia and loss of weight.

The history dated back to May, 1930, when the patient first began to have a dull ache in the left loin. In July she began to be troubled

with acute attacks of pain, and also with frequency and urgency of urination. She never noticed any gross hematuria.

The general physical examination revealed tenderness and resistance in the left flank and in the left lower quadrant of the abdomen. There was also considerable tenderness in the left loin. No masses or enlarged glands were palpated.

Laboratory findings were as follows: Urine was cloudy, straw

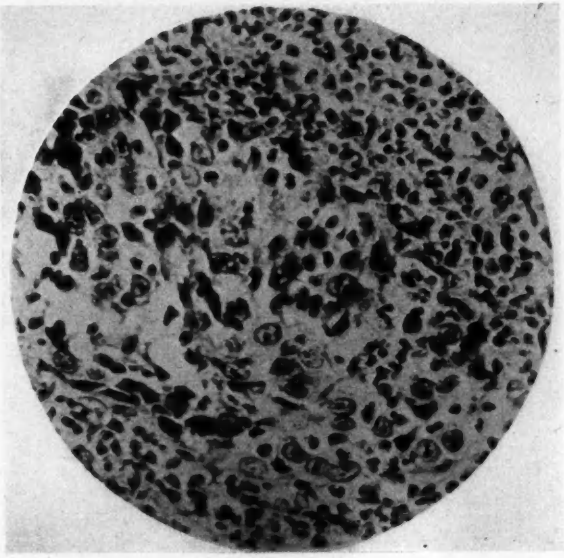

Fig. 11. Case 3. Photomicrograph of a metastatic growth of the left ureter secondary to a growth in the cervix. Note the immature epithelial cells lying in small clusters. There is also considerable exudative inflammatory reaction with many eosinophiles.

colored; acid, 1.008; albumin, x; sugar, none; pus, x; red blood cells, x; epithelial cells; no casts. One cubic centimeter of phenolsulphonephthalein injected intramuscularly gave, the first hour, 60 per cent; second hour, 20 per cent; total, 80 per cent. Blood chemistry showed non-protein nitrogen, 21.3 milligrams per 100 c.c.; creatinine, 1.39 milligrams per 100 c.c. Blood count gave red blood cells, 3,950,000; white blood cells, 6,250; hemoglobin (Sahli), 60 per cent. Blood Wassermann test was negative.

X-rays did not reveal any metastases in the lungs or bones.

Cystoscopic examination revealed a definite obstruction at the junction of the middle and upper third of the left ureter. A ureteropyelogram on the left side showed a definite constriction about the middle of the ureter. There was also evidence of a dilated upper ureter with destruction of the corresponding kidney (Fig. 9).

A diagnosis of an obstructed ureter with a destroyed and infected hydronephrosis left was made.

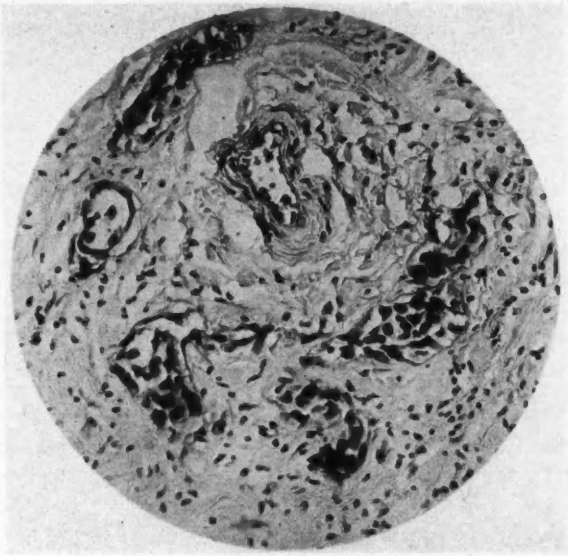

Fig. 12. Case 3. Photomicrograph showing the definite perivascular lymphatic invasion by cancer cells in a metastatic growth of the left ureter secondary to a carcinoma of the cervix.

The patient was operated upon and a nephrectomy and partial left ureterectomy was performed. At operation the kidney was very adherent and there was found a double pelvis and branched ureter for the upper third. Where the two ureters joined was a hard mass the size of a large grape. This mass was markedly adherent to the spine. It was removed together with the kidney and double ureter.

Gross specimen consisted of a pale kidney measuring 12 × 6 cms. Two ureters emerged from the pelvis and joined after running separately for 7 cms. At the point of junction the walls were greatly thickened by a diffuse circular growth (Fig. 10).

Sections from the nodule at the junction of the ureters showed the ureters embedded in fibrous scar tissue which was the seat of a malignant growth of immature epithelial cells lying in small clusters in lymphatics and perivascular lymphatic spaces. There was considerable exudative inflammatory reaction with many eosinophiles. The lining epithelium of the ureters was for the most part well preserved, and there was no evidence that the growth had originated from this source. The cancer cells grew in solid fashion without keratinization (Figs. 11 and 12).

Anatomical examination revealed carcinoma solidum metastatic from carcinoma of the cervix.

DISCUSSION

The diagnosis of a new growth of the ureter, whether primary or metastatic, is made, almost always, at operation or on the autopsy table. There are no symptoms or signs that are pathognomonic and the condition is only rarely considered.

The outstanding symptom is pain. This may be represented by a dull, steady ache on one or the other side, or may simulate a severe renal or ureteral colic. Hematuria is a variable symptom. In primary growths it occurs at one time or another during the course of this disease, and may be profuse or very scanty. In metastatic growths on the other hand hematuria will not occur unless the growth has encroached upon the lumen of the ureter. Frequency, urgency and dysuria of urination are occasionally complained of, and usually result from a secondarily infected hydronephrosis and hydroureter.

Cystoscopic examination gives us the most information. Ureteral catheterization usually reveals a stricture at the site of the growth, and a ureterogram demonstrates the narrowed portion of the ureter and the dilatation just above it. This picture is well demonstrated in Figure 9.

This patient had all the symptoms and signs just described. In addition she had a history of a carcinoma of the cervix. In spite of these aids a diagnosis of a growth in the ureter was not made. We must confess that we considered the stricture of the ureter as due to the radium therapy.

CONCLUSIONS

1. True metastatic growths of the ureters are extremely rare conditions.

2. We must not confuse metastatic growths of the ureter with those resulting from direct extension of tumors of adjacent organs.

3. In metastatic growths of the ureters malignant cells can always be demonstrated in the perivascular lymphatic spaces or blood vessels about the ureter.

4. A diagnosis of a new growth of the ureter whether primary or metastatic is almost always made at operation or in the post-mortem room.

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DIVERTICULUM OF THE URETER: A REPORT OF THREE CASES

HENRY G. BUGBEE, M.D.
New York

A review of the literature on the subject reveals the fact that diverticulum of the ureter is a rare clinical and anatomical finding. It has been produced experimentally; in four instances, the lesion has been found at autopsy; seven clinical cases have been reported; to which the writer adds three more.

Lindermann,[6] in 1895, after partially ligating the ureters close to the bladder, in young rabbits, produced ureteral diverticula. One of the diverticula contained 40 c.c. of urine. When the ligature was made in the middle or at the renal pelvis no diverticulum was formed, nor was one produced in older animals. Microscopical section of these diverticula showed the same coats as found in the ureter—the muscular coat was thinner and the external connective tissue layer was thicker than those found in the ureter. Lindermann believed that these diverticula were produced by the raising of intrarenal pressure, aided by contractions of the ureter, especially in the distal portion.

Wolf,[18] in 1900, presented an autopsy specimen of a diverticulum of the ureter from a patient with a single kidney, the opposite kidney having been removed fifteen years before, and a left nephropexy done five years previously. The diverticulum produced no symptoms. Wolf believed that the diverticulum in this case was of an acquired type, due to increased work of the left kidney after the removal of the right one, and that it was, like the dilated ureter, a compensatory change. He stated that ureteral diverticula were as a rule congenital, and situated at the medial side of the ureter; that if of considerable size, they produce symptoms and might be mistaken for bladder tumors or cysts.

Herbert,[1] in 1905, reported a diverticulum 32 mm. in length arising from the left ureter 3 cm. above the bladder. This specimen was found in a cadaver.

Pepere,[11] in 1908, reported multiple diverticula of the ureter

found at autopsy. There were four of the right and three of the left ureter, varying from 3 to 5 cm. in length.

Guiteras,[2] in 1913, cited an autopsy specimen of a shallow cul-de-sac coming off from the intramural portion of the right ureter immediately above the ureteral meatus.

The first clinical reports of cases of diverticulum of the ureter, reported in the living, were in July, 1921, when one case was reported by Hale and Von Geldern, and one by Neff.

Hale and Von Geldern's[3] case was a male patient, twenty-seven years of age, who had complained of non-radiating pain in the left lower quadrant for seven years. A ureteral catheter was obstructed at the sacral promontory. A ureterogram demonstrated the diverticulum. Urine from this catheter revealed the presence of an infection. A fusiform sac 5 cm. in length, communicating with the ureter 10 cm. from the bladder, was removed, with relief of the symptoms.

These writers gave as the three possibilities as to the etiology of ureteral diverticula: (1) a secondary budding of the metanephric anlage, (2) a compensatory structure following a congenital stenosis of the ureter, (3) an acquired structure occurring later in life following an acquired ureteral stricture. The second explanation seemed to them the most plausible. Sections of the diverticulum after removal showed the same structure as the ureteral wall. The symptoms were apparently caused by an acute inflammation in the diverticulum.

Neff[8] reported a case of a male patient, thirty-two years of age, who had complained of repeated attacks of right renal colic, over a period of eighteen years. He had not passed blood nor calculi. A diverticulum 13 cm. by 2 cm. was found after passing a ureteral catheter which was obstructed 10 cm. above the bladder, and in the radiograph found to be looped in the diverticulum, which was further demonstrated by a pyeloureterogram. The diverticulum was excised and the ureter repaired at its point of branching 8 cm. above the ureteral orifice into the bladder, with a complete relief of symptoms. Neff states that diverticulum of the ureter represents the incompleted development on one side of two pelves, or possibly two kidneys. This explanation is in accord with that of Wilhelmj[17] who found a similar deformity in an anatomical sub-

ject, in which case there was an almost complete duplication of the left ureter, one ureter failing to secure a nephrogenic capping.

Marsella,[7] in 1924, reported the case of a diverticulum the size of the end of the thumb, in a male patient thirty years of age, removed at operation with re-implantation of the ureter into the bladder. This patient complained of frequency and dysuria, due to infection. The diagnosis was made by radiograph after a ureteral catheter had been obstructed in its passage, the radiograph showing the catheter coiled up in the diverticulum. In this case, the ureter emptied into the diverticulum and the mouth of the ureter was replaced by the mouth of the diverticulum. Marsella was convinced from the development and conformation of the musculature, the special form of the diverticulum, and the narrowness of its opening into the bladder, that this was a case of congenital malformation.

Nickolic,[9] in 1926, reported a diverticulum of the ureter in a female patient, thirty-four years of age, who entered the hospital because of uterine hemorrhages from carcinoma. Cystoscopic examination showed edema about the right ureteral orifice. A ureteral catheter was obstructed at 10 cm. and a ureterogram demonstrated a sac 12 cm. long, the width of the thumb, leading from the ureter and ending blindly, with a dilated ureter lying to the outer side of this sac. A Wertheim operation was carried out, and at the same time the right kidney and ureter were removed. The diverticulum was found to join the ureter at a point 10 cm. above the bladder and was 15 cm. in length. The patient made a good recovery.

Stevens,[16] in 1926, in his paper before this Society, reported the fifth case in the living, a male patient, fifty-nine years of age. This patient's illness of four weeks' duration was characterized by chills and fever, with pain in the left lower abdomen and no urinary symptoms. Tenderness was present in the left costovertebral angle and a mass palpable along the sigmoid. The urine from the left kidney contained pus. A ureterogram showed a dilatation 8 cm. by 5 cm. just below the kidney pelvis. At operation the kidney and upper 8 cm. of the ureter were removed. The kidney, the seat of multiple cortical abscesses, contained a calculus in the upper calix, and the pelvis and calices were dilated. There was a marked perinephritis. Two small sacculations, one of which had ruptured,

the second 2 mm. in depth, were found in the upper ureter. Sections through the sacculations showed the surfaces covered with epithelium.

In his report Stevens cites a personal communication from Hunner of a case operated by the latter which had previously been diagnosed by Crowell as a probable ureteral diverticulum. A ureteral stricture was dilated, but the sacculation, which was apparently below the stricture in the films, was not studied at operation.

Rathbun,[13] in 1927, reviewed the literature of diverticulum of the ureter, citing the cases already mentioned, with the exception of Nickolic's, reported in 1926. Rathbun mentioned reports by Pallet,[10] in 1921, Schroeder,[15] in 1922, and Pribriam,[12] in 1925, of cases classified as diverticulum of the ureter, but which were undoubtedly cases of ureterocele. A review of these papers, as well as an additional one by Rosenthal,[14] in 1925, reporting four similar cases, shows that none of these were cases of true diverticulum of the ureter and can be excluded from the tabulation of cases.

Rathbun's case was a boy, ten years of age, who complained of frequency, dysuria, and occasional hematuria for a period of two years. At cystoscopy catheters were passed which seemed to advance to the kidneys, but were found in the radiographs to be coiled up in the lower ureters. The urine from each side contained pus and colon bacilli with markedly diminished renal function. At operation a diverticulum, into which the ureter emptied on each side, and from which there was a tiny communication into the bladder, was removed and the ureters re-implanted into the bladder. Each diverticulum measured 2 cm. by 4 cm. in size and connected with a somewhat dilated ureter. The boy made a good operative recovery.

In a personal communication to Rathbun, by Keyes,[5] an additional case of a diverticulum of the ureter was included in his report. Keyes' case, a male patient, thirty-seven years of age, had had repeated attacks of severe pain in the left loin. Cystoscopy showed a diverticulum of the bladder. A catheter passed into the left ureter was found in the radiograph to be coiled up in the lower ureter. Urine from this catheter contained pus, and the kidney showed diminished function. At operation a diverticulum of the left lower ureter was found and removed.

The three cases which I wish to add to the seven already reported in the living, are as follows:

Case 1.—A report of this case under the following title, "An Unusual Case of Lithiasis Illustrating the Value of Kidney Drainage with Ureteral Catheter, of Pelvic Lavage and Intra-ureteral Manipulation" was made by the writer in 1918.[1] A diverticulum of the ureter was demonstrated at that time, and illustrations accompanying the article showed a ureteral catheter making a loop in the diverticulum, and a ureterogram further revealed its position and size.

This patient, female, thirty-four years of age, was seen during March, 1914, three months after a ureterotomy for the removal of a calculus impacted in the right ureter at the level of the brim of the pelvis. She had suffered from intermittent attacks of right renal colic for three years. Following the ureterotomy, a urinary fistula had persisted, all the urine from the right kidney draining through this fistulous tract. On cystoscopic examination, the left ureter was catheterized easily; the urine from this kidney was acid, showed pus and blood cells and colon bacilli. On the right side the catheter encountered an obstruction at 8 cm. but passed to the kidney after manipulation. There was a more rapid flow of urine from this kidney—it was alkaline, contained a sediment of blood and pus cells and many colon bacilli. The catheter was retained in the right kidney for six days, at the end of which time the urine became clearer and drainage from the fistula ceased. Following the removal of the catheter the patient had a typical attack of renal colic and passed a calculus. During this attack and since then the fistula has never re-opened and the patient's general condition improved rapidly. A month later the patient had another colic. An obstruction encountered with the ureteral catheter, at the same level as before, was passed after manipulation, the catheter retained twenty-four hours, and following its withdrawal another calculus was passed. A soft ureteral catheter was now passed to the kidney and a radiograph showed the catheter coiled in a diverticulum (Fig. 1) at the level of the pelvic brim.

During 1916, ten calculi were passed following intraureteral manipulation. In 1917, ureteral catheters were retained for seven days, and in July, 1917, following a severe colic, a calculus 3.5 cm. by 1.5 cm. was loosened by manipulation, from the ureter below the diverticulum, as demonstrated by a series of radiographs, and was passed by the patient.

With the passage of this calculus, the diverticulum above became reduced in size, the urine cleared of infection, function of this right kidney became much improved, and no more calculi were formed.

A cystoscopic examination was made May 15, 1931, fourteen years after the passage of this large calculus. Both kidneys are free of infection, as shown by the absence of pus cells, and negative cultures.

The function of the right kidney which, in 1924, was one-fourth that of the left, is now five-sixths that of the left. Pyeloureterogram shows no diverticulum of the right ureter, which demonstrates the fact that this diverticulum was of the acquired type, due to increased intra-ureteral pressure caused by partial obstruction of the lower ureter, and occurring at a point where the ureter had been weakened by traumatism incident to the ureterotomy.

Fig. 1. Catheter coiled in diverticulum of the ureter at the level of the pelvic brim.

Case 2.—Female patient, thirty-three years of age, single, had a negative medical history until one week before she came under observation, November 5, 1928. During this week she had had a well marked hematuria without frequency or dysuria. General physical examination was negative. The bladder urine was deep red, turbid with dense bloody sediment, 1.014, heavy trace of albumin, urea 1.2 per cent, small number of pus cells, very large number of blood cells (comprised most of the sediment), moderate number of calcium oxalate crystals, vesical epithelia, no bacteria. Hematuria ceased six days later, and a cystoscopic examination made at that time showed a normal bladder. The right ureteral orifice was normal, a catheter passed to the kidney without difficulty, and the urine from this kidney was normal, as was the radiograph of ureter and kidney.

The left ureteral orifice was small and round. A catheter passed 5 cm. and was obstructed. With manipulation it passed 20 cm. and again manipulation was necessary to advance the catheter into the kidney pelvis. The urine from the left kidney contained oxalate crystals, a small number of blood and isolated pus cells. Radiographs showed the catheter forming a complete loop in a diverticulum of the lower left ureter (Fig. 2) and then advancing to the kidney. There

Fig. 2. Catheter coiled in diverticulum at lower end of left ureter.

was no evidence of urinary calculus. One week later the ureteral wall was cut, enlarging the left ureteral orifice. This ureter was further dilated, since which time the patient has been entirely free of symptoms.

Cystoscopic examination June 1, 1931, showed a diminution in the size of the diverticulum of the left ureter, and the urine was clear. In this case the diverticulum was a congenital type secondary to a stenosis of the ureter at its orifice. The deposit of oxalates and infection on this side were probably secondary to poor drainage and led to the discovery of the diverticulum.

Case 3.—Female patient, fifty-four years of age, married, no children, was seen February 7, 1930. She had had a bilateral salpingo-oöphorectomy in 1918. In 1926 she developed a left-sided colic which was severe and subsided without hematuria or passing a calculus. In 1928 she had another attack of pain in the left loin which was severe, and at that time passed a small stone. For six weeks she had had dull pain in the left side of the abdomen and back, but had passed no calculi. The patient was obese and showed a moderate degree of

Fig. 3. Catheter coiled in diverticulum in lower end of left ureter.

visceroptosis, but otherwise the general physical examination was negative. The kidneys could not be palpated, and no tenderness was elicited in either loin.

Cystoscopic examination showed a congestion of the trigone and moderate pressure upon the bladder from the uterus. The right ureteral orifice was normal, the left was smaller but otherwise negative. A catheter passed to the right kidney without difficulty, clear, negative urine was obtained, and radiographs of the ureter and kidney were also negative. On the left side, the catheter was obstructed at 4 cm., but after manipulation was passed 30 cm. Radiographs showed the

catheter coiled up in a diverticulum of the left ureter (Fig. 3). Urine from the left kidney showed albumin, pus and blood cells, diminished function, and the cultures a profuse growth of staphylococcus albus. A ureterogram demonstrated the diverticulum (Fig. 4), extending from a point 1.5 cm. above the ureteral orifice upward about 7 cm. with a width of 3.5 cm.

Attempts were made to dilate the ureter leading from the diverticulum. Drainage of the diverticulum was not improved by these ma-

Fig. 4. Diverticulum of lower end of left ureter.

nipulations. By passing a large ureteral catheter into the diverticulum the capacity of the diverticulum was found to be 135 c.c. There was a continuous flow of urine up to this amount, when it became intermittent, as in a normal ureter. The infection did not diminish. Functional tests showed normal return for the right kidney and no dye in ten minutes from the left.

At operation May 15, 1930, the left lower ureter was exposed through an extra-peritoneal incision. A diverticulum was found 7 cm. by 3.5 cm. in size extending upward from a point 2 cm. from the ureteral orifice in the bladder. The ureter above the diverticulum was slightly dilated. The ureter was cut off at the bladder, and as a re-

section of the diverticulum with re-implantation of the ureter into the bladder would have resulted in too great tension on the ureter, and as the left kidney function was poor, a nephro-ureterectomy was deemed advisable. The ureter was freed to a point well above the pelvic brim, and cut off. The kidney and upper ureter were removed through a lumbar incision. Convalescence was uneventful.

The patient when last seen May 25, 1931, was in excellent health.

This large diverticulum was secondary to a congenital stenosis of the lower ureter, as in Case 2. Owing to poor drainage, it became the seat of infection and calculus formation, which gave rise to symptoms, and thus led to its discovery.

This review of reported cases and the study of the writer's cases confirms the theories advanced by the earliest reporters as to the etiology of diverticulum of the ureter, *i.e.* that they are congenital or acquired. The congenital diverticula are due to an abortive attempt at the formation of a second ureter, as in the cases of Hale and Von Geldern, Neff, and Nickolic; or secondary to a congenital stenosis of the ureter, in which case, with the establishment of kidney function, there is an increase of intra-ureteral pressure, and a compensatory diverticulum results, as in the cases of Marsella, Rathbun, Keyes, and the second and third cases reported by the writer. The lower ureter seems to be especially prone to this dilatation. Acquired diverticulum, as in the writer's first case, occurs later in life following an acquired ureteral stricture, or prolonged obstruction of the ureter.

Of these ten clinical cases, six were in males, and four in females. Five were diverticula of the lower ureter, each undoubtedly secondary to a congenital stenosis of the lower end of the ureter. Three were elongated blind sacs leading from the ureter at a point 10 cm. from the bladder. The fact that in all three the diverticulum joined the ureter approximately at the same point, may be significant. These three cases represent an abortive attempt at the formation of a second ureter. Stevens' case is the only one not diagnosed before operation, and in which the diverticulum was found in the upper ureter.

In the nine cases of diverticulum of the lower ureter a ureteral catheter was obstructed in its passage, and in all except the cases of Neff and Nickolic a radiograph taken after its passage showed the catheter coiled up in the diverticulum. The diagnosis was verified by a ureterogram in each instance.

In six cases, pain in the side of the abdomen on which the diverticulum was located was a predominant symptom. Urinary symptoms, frequency of urination, and dysuria, were noted in nine, and hematuria was the only symptom in one (the second case reported by the writer).

A congenital diverticulum of the ureter, like a congenital hydronephrosis, may be present and give rise to no symptoms until later in life, when, due to infection or calculus formation, symptoms arise which lead to urological investigations, which in turn reveal the presence of the diverticulum.

With the advent of intravenous urography, it is possible that diverticula of the ureter will be discovered more frequently. Soft, pliable catheters are liable to encounter a diverticulum by being obstructed in their passage, or to demonstrate its presence by coiling up in the diverticulum.

The treatment of diverticulum of the ureter is largely surgical, as in eight of the ten reported cases. Two were relieved by dilatation of the ureter and intra-ureteral manipulation, thus establishing free drainage of the diverticulum.

If the diverticulum consists of a blind pouch, as in the cases of Neff, Hale, and Von Geldern, and Nickolic, the sac may be excised and the opening into the ureter closed. If the ureter empties into the sac, and there is a terminal ureter through which the diverticulum empties into the bladder, a resection of the ureter and reimplantation of the ureter into the bladder is indicated, unless the diverticulum be so large that the ureter would be subjected to too great tension, or should the kidney be badly damaged by infection, in which case a ureteronephrectomy would be indicated.

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A. SIMULTANEOUS INTRA-PERITONEAL AND EXTRA-PERITONEAL NEPHRO-URETERECTOMY

B. URETEROVAGINOSTOMY FOR PYO-URETER

EDWARD L. KEYES, M.D., F.A.C.S.
New York City

Ureterectomy, or more properly speaking nephro-ureterectomy, is performed for neoplasm or for retentive inflammatory lesions, including stone and tuberculosis. The considerations governing the choice of operation are not the same for tumor as for inflammation. Nephro-ureterectomy for tumor deals with a ureter that is not densely adherent and implies resection of the bladder wall about the ureteral orifice. Such an operation is more safely done extra-peritoneally. But the operation of ureterectomy for hydro- or pyo-ureter implies a ureter at least widely distended and perhaps so adherent that it is difficult to remove. Under these circumstances intraperitoneal attack might seem unsafe. Indeed we are familiar with the peritonitis that results from ureteral implantation into the intestine. Yet the very conditions that favor peritoneal infection after ureter implantation are absent after ureterectomy. The infecting urinary stream is suppressed. Any soiling of the peritoneum that takes place at the time of operation due to slipping of clamps or tearing of the ureter may be perfectly cared for at the time. Hence the many intraperitoneal ureterectomies to be found in the literature. We are familiar with the depths of the pelvis and do not need to be persuaded that the intraperitoneal approach to the lower ureter is incomparably the easier. And for precisely the same reasons the extra-peritoneal approach to the kidney is obviously to be preferred. Let me cite a case that illustrates two points, *viz.*, the larger the ureter the harder it is to identify it retroperitoneally, and equally the easier it is to remove it from within the peritoneum.

Case 1.—Infected hydronephrosis and hydroureter. Extraperitoneal failure to identify the ureter. Intraperitoneal ureterectomy and extra-peritoneal nephrectomy. Cure.

J. K., white, male, aged twenty-two years, was brought to consult me by his physician on July 19, 1930. His urological history was as follows:

In 1912 a left renal colic accompanied by vomiting was followed by discomfort in urination. Similar attacks occurred three or four times a year thereafter until on June 8, 1930, he had a colic of unusual severity lasting eight days. Urogram at that time showed an enormously dilated pelvic ureter but it had been impossible to pass the catheter beyond the ureteral orifice and though the operation was repeated, no urogram of the upper ureter or kidney pelvis was obtained. Uroselectan was administered but no shadow was obtained on the left side.

Fig. 1. Infected hydrometer of Case 1.

Therefore on June 24, a general surgeon with the assistance of the urologist who had made cystoscopic examination, opened the left inguinal region extraperitoneally and searched in vain for the ureter. The discussion following this operation was so intense that two days later the patient was again anesthetized, his wound re-opened by the same two gentlemen and again no ureter was found.

I put the patient in hospital and on July 31 performed cystoscopy and found a superficial ulceration of the trigone which the urologist attributed to his previous cystoscopies. No catheter could be introduced above 3.5 cm. in the left ureter. The sodium iodide solution to be injected was, therefore, tinged with indigo-carmin and 30 c.c. in-

jected before reflux was noted in the bladder. The resulting urogram was precisely the same as those previously obtained (Fig. 1).

The patient's condition was good, his urine was of good density and contained only a few pus cells. The right kidney was uninfected and its function seemingly normal. The blood chemistry was normal. Wassermann test was negative. P.S.P. excretion was 51 per cent in thirty minutes after intravenous injection. Both loins were normal to palpation.

The somewhat unsatisfactory diagnosis, the possibility of a pelvic kidney and the presence of a good deal of fresh scar in the inguinal region all seemed to indicate a laparotomy through the left rectus as the normal route of approach. The peritoneum was accordingly opened under nupercaine spinal anesthesia and an enormously distended left ureter exposed; this extended into the loin. Ureteronephrectomy was called for but I hesitated to extend the incision as would have been necessary in order to make the whole operation intraperitoneal. Moreover, it would have been fantastic to attempt an extraperitoneal ureterectomy. Therefore, the peritoneum was incised over the ureter and this duct doubly clamped and divided at the pelvic brim. It was not difficult to separate the pelvic ureter down to its stricture at the bladder wall. But the precaution of emptying the ureter upward before clamping and dividing it had not been taken so that when the ureter was clamped for separation from the bladder and the clamp slipped, the peritoneum was soiled with urine. This was mopped up and the wound mopped with 1/1000 acriflavine. The pelvic ureter was excised, the upper stump ligated. A long cigarette drain was placed along the track of the pelvic ureter since this had been soiled with infected urine and the upper end of this drain stuffed into the loin below the kidney. Peritoneum was then sutured over this and the anterior abdominal wall closed without drainage. The patient was then turned on his side and a large, totally destroyed, hydronephrotic kidney and upper ureter were removed and the upper end of the pelvic cigarette drain brought out through the loin. Time of operation was one hour and twenty minutes. Convalescence was uneventful. Maximum temperature, post-operative, was 101° F. The drain was left in for a week. The patient went home with his wound healed on the eighteenth day.

There are ureters so sunk and adherent in masses of scar that, entirely regardless of the problem of peritoneal infection, it would seem quite impracticable to dislocate them without tearing the iliac vessels. Indeed it may be remembered that many years ago Schlagintweit reported a tear of the iliac artery at the pelvic brim as he was dissecting an adherent ureter from it.

As Case 2 will prove, I was slow to realize that uretero-vaginal fistulization is the solution of this problem in some cases.

Case 2.—Ureteral reduplication. Pyo-ureter extending to position behind the bladder neck. Nephrectomy, partial ureterectomy, ureterovaginostomy. Cure.

The patient, colored, female, thirty-seven years old, married, consulted me on February 14, 1924, for pains in the right loin of an intermittent colicky character which from 1910 to 1914 had occurred three or four times a year and then recurred once a year in 1922, 1923, and 1924. The last attack had been very severe with temperature for a week to 101°, and pus and red cells in the urine.

Palpation revealed a slight enlargement of the right kidney. Ureter catheterization revealed no hydronephrosis and a urea concentration of three grams to the liter on the right side as compared to five on the left, a P.S.P. excretion of 7 per cent against 16 per cent in the first ten minutes of its flow and the quantity of urine 4.5 c.c. from the right kidney and 7 c.c. from the left. There was no pus or bacteria from either side. No pyelogram was taken. Subsequent observation proved that the right ureter catheter had drained the lower half of a right kidney provided with two ureters but this was not suspected at the time.

Though no cystitis was seen by the cystoscope, it was assumed that the urinary pus came from the bladder and as this was small in amount and the patient's attack was about over and the radiogram negative, she was dismissed with the assurance that she probably had passed a stone and would hear no more of it.

On March 10, 1930, she returned in poor condition from a recent, prolonged fever and severe attack of unremitting pain in the right loin, which was filled by a very large and somewhat movable mass. The cystoscope again showed no cystitis; there was a good concentration of indigo-carmin from the left kidney and faint one from the right. The urogram was interpreted as a large tumor at the lower pole of the kidney, or a malformed kidney. The actual condition of ureteral reduplication with pyonephrosis of the upper half of the kidney was suggested by the findings but was not considered.

On March 13, 1930, the right kidney was exposed and the ureteral reduplication promptly recognized. The pyonephrosis of the upper half of the kidney was so large and fixed that it seemed prudent to evacuate it before attempting to remove it. The kidney was then readily removed and the large pyonephrotic ureter followed to the brim of the pelvis, where it was still dilated and quite firmly adherent to the iliac vessels. Further exploration was therefore abandoned. The stump of the ureter was fastened to the lower end of the wound and a 38F. suprapubic tube tied into it. Drainage from the sinus was very profuse.

On May 20, 1930, the injection of the sinus (Fig. 2) had shown a suggestion of a large pocket at the pelvic brim and little dilatation of the ureter below this, while cystoscopy had failed to reveal the orifice

of the pyo-ureter. An unsuccessful attempt was therefore made to remove the lower end of the right ureter through an oblique abdominal incision. Adhesions were so old and so dense that the ureter could not be approached extraperitoneally so the peritoneum was opened and after removal of the right ovary the peritoneum was separated from the posterior abdominal wall mesial to the dilated ureter and the peritoneal cavity thus closed off, after which the adherent ureter was opened and found "extremely dilated, thickened, tortuous, filled with stinking, watery pus. The adhesions were so dense, the ureter so

Fig. 2. Injection of loin sinus in Case 2.

tortuous and the closure of the peritoneum so frail that it was deemed unwise to attempt to excise the ureter both for fear of peritoneal infection and of grave hemorrhage. The loops of ureter were opened in turn and evacuated and the mucous membrane cauterized with the actual cautery." A 22F. catheter was left in the lowest loop of ureter at about the region of the upper end of the trigone.

The fistula continued to discharge and, though a thickened mass of ureter had been made out by vagina behind the bladder, it was assumed that this could be excised abdominally so a third operation was performed on September 30, through a median laparotomy incision with the primary object of tying the right uterine artery and excising the whole

retrovesical mass. After division of the right broad ligament the uterine artery could not be exposed or even palpated because of the dense scar surrounding the ureter. An extra peritoneal suprapubic opening of the bladder was therefore made and on the right side of its fundus the projection of the thickened ureter could be seen. This was opened and the finger introduced into the dilated ureter which ran down to a position behind the bladder neck. The orifice of the ureter was closed but had doubtless been in the urethra. A Kelly clamp was pushed through the lower end of this cavity coming out into the floor of the urethra and through this opening a drainage tube was drawn. The uretero-vesical fistula was then closed and the suprapubic bladder wound sutured without drainage. An indwelling urethral catheter was inserted.

The patient had no undue reaction from this operation nor from either of the preceding ones. Now the groin fistula was replaced by a uretero-urethral fistula with a tube in it. After waiting for the bladder wounds to become firm, on October 17, "the tube was removed from the uretero-urethral fistula and replaced by a grooved director. The upper edge of this was pressed downward, making the antero-lateral wall of the vagina bulge on the right side. The vaginal wall was incised over this and then the cavity of the dilated ureter opened and its mucosa sutured to that of the vagina for a distance of about 3 cm., in order to leave a permanent uretero-vaginal fistula." Thereafter this uretero-vaginal fistula was kept open by digital stretching every two weeks. On four occasions caudal anesthesia was required to make this painless. Since April 1, 1931, the patient has been seen but once a month. The uretero-vaginal fistula readily admits a finger and now discharges but little pus. The groin fistula has long since healed. The patient has considered herself well since recovery from the last operation.

SUMMARY

The two operations reported are proposed, the one as a convenient method of nephro-ureterectomy for hydro-ureter, the other as a vent for the pyo-ureter which the surgeon can not remove.

Attention is directed to the fact that suppression of the urinary stream by nephrectomy safeguards the peritoneum from infection.

DISCUSSION

DR. J. I. FARRELL: On our service at the Post Graduate Hospital (Dr. McCarthy's service), we recently had a woman, aged thirty, who complained that in January when trying to stoop over to pick up something on the floor she was unable to straighten up. She claimed that since that time she had been walking with a stoop and that her left leg and left hip region were quite painful. The woman was examined quite thoroughly by the Medical Department and they arrived at no diagnosis. The problem seemed to be orthopedic in nature and she was therefore referred to the Orthopedic Department for examination. Because of the fact that she complained of pain on motion of the hip when she was walking, and when she was lying in bed she had no pain on passive motion of the hip, the woman was diagnosed as having hysteria.

The Urological Department of the Hospital was asked to see her primarily because of the presence of pus in the urine. At that time we elicited the following urological history: In 1929 during a pregnancy she had some uremic convulsions through which she was carried successfully. Six months later the left kidney was removed for nephrolithiasis. Since that time she has had no great difficulty on urinating but she did have an unexplained temperature running from 101 to 104 at times, for no good reason. She went back to our original urologist and explained the whole condition. He decided that in all probability the condition was urological in nature.

When she came to the hospital, during the cystoscopic examination, a heavy pus was exuding from the left ureter. A ureterogram made at that time showed a huge, dilated ureter extending up into the left groin. We were not able to outline any large sac in the groin and from the symptoms of the painful movement of the hip, we felt that the infected ureter was involving the psoas muscle. The woman was prepared for operation and a left rectus incision made, the whole operation being done extra-peritoneally. We found an abscess in the psoas muscle. This was dilated, and, peculiarly enough, was adherent not in the pelvis but over the left iliac region, and had to be excised with a great deal of care.

We excised the ureter and inserted a drain in the lower part of the wound to take care of the abscess in the psoas muscle. The woman has made quite an uneventful recovery.

The interesting thing, from our standpoint, was that this patient came to us about March 10, was in the hospital for twenty-one days, and everybody in the hospital had diagnosed the case as a hysteria. From the standpoint of physical examination, however, she had no tilting of the pelvis and no pain on passive motion of the hip, but on cystoscopic examination there was no doubt about the infected pyo-ureter on that side.

DR. NATHANIEL P. RATHBUN (Brooklyn): In discussing Dr. Bugbee's case, I thought it might be of interest to report a follow-up on my case of bilateral diverticula of the ureter.

(Slide) Just briefly to present the case, this shows both ureter catheters coiled in the diverticulum. In fact, we thought when we had passed these catheters at first that they had gone to the kidney pelvis.

(Slide) This shows the diverticulum on one side injected.

(Slide) This shows both catheters withdrawn; the diverticula shown here; the bladder injected with air.

The boy reported on Tuesday of this week, four and a half years following operation. He feels and looks perfectly well; he urinates once a night; his urine contains a moderate amount of pus; he has a normal blood chemistry; urea 28, creatinin 201, phthalein 8.

(Slide) This is a diagrammatic sketch of the conditions found at operation, these being the diverticula. The ureters were resected at this point and implanted in the bladder up here.

(Slide) This is an intravenous urogram made last Tuesday. This is the ten-minute picture, which shows a moderate degree of hydronephrosis on each side.

(Slide) This is a three-hour picture. This boy should have been catheterized but he wasn't. The slide shows the ureter entering the bladder up here; not very good kidneys, apparently, but the boy is in good condition.

In discussing Dr. MacKenzie's case, I would like to show one or two slides. My case of carcinoma of the ureter was secondary

to carcinoma of the male breast, for which a radical operation had been done five years previously. The patient remained well without any signs of local development and five years later developed a hematuria.

(Slide) The kidney was removed and showed a sclerous carcinoma at the upper end of the ureter near the kidney pelvis, and the kidney in fairly good shape.

(Slide) This shows the carcinoma at this point and the kidney, before it is split, the dilated kidney pelvis.

(Slide) This shows the kidney split open and the carcinoma of the ureter here. One rather remarkable thing about this case was that the slides of the old breast tumor and the slides from the sclerous carcinoma of the ureter were very, very similar.

(Slide) This is the picture of the sclerous carcinoma of the breast removed five years before.

(Slide) This is a section made from the ureter with rather a similar cellular arrangement. McCarthy of the Mayo Clinic studied these slides and graded them "4". It seems rather remarkable that this man should be alive and well with this one small metastasis five years after the radical removal of carcinoma of the breast, with the development of a carcinoma of the ureter five years later.

I had rather an unusual case of a huge ureter. The woman presented symptoms somewhat similar to the patient reported by Dr. Farrell, namely, intermittent attacks of fever with pyuria and bladder disturbance. There was a complicating large fibroid with rather large veins in the broad ligament which made it very difficult to dissect out the ureter. I was very much interested in Dr. Stevens' paper because I have a case in which the same operation was indicated, but I have always been a little bit suspicious of these cases with persistent bladder ulcers and tubercle bacilli. It seems to me that is a very difficult thing to exclude.

DR. NATHANIEL G. ALCOCK (Iowa City): I would like to discuss two phases of these papers that have been presented.

In Dr. Crenshaw's case, the one with the double ureter, with the one on the right side going up to the left, as I understand it, the orifice of the ureter was just about in the urethra. Is that right?

DR. CRENSHAW: Just on the vesical side of the sphincter edge.

DR. ALCOCK: I think those cases are important. I believe there are more of them than we recognize. I have had one case, similar to that, in a woman who had two ureters opening into the bladder, two ureters opening just into the urethra and one of them going up to a hydronephrosis on the left side. If I understood correctly, in one of Dr. Keyes' cases there was a large opening on the right which opened up into the urethra. I have had two cases where the second ureter on the right side opened up into the prostatic urethra. The curious thing in one case was that the ureter that opened into the prostatic urethra opened into the left side of the verumontanum. In the first case I removed the kidney and a portion of the ureter, and never had to remove the rest of the ureter. In the second case, I removed about half of the ureter, but the symptoms and findings of pyuria, and all that, went on exactly the same. The removal of this enormous sac had done the patient no good. So about two or three weeks ago I operated again and removed the large second ureter down to as near its insertion as possible. I left about that much of it (indicating), and it holds about 10 or 15 c.c. His symptoms are going on the same as they were before. Therefore, if we are going to take those ureters out, we must get the whole thing out clean, because, in one of my cases at least, the symptoms have gone on the same as before. I think, however, that there are more cases of double ureters with one ureter opening into the urethra than we think there are. I have had three of them in a period of four years.

DR. HUGH CABOT (Rochester, Minn.): In discussing Dr. Stevens' paper and the remarks just made by Dr. Rathbun, my experience is limited to one patient in whom, under very similar conditions with intolerable bladder frequency and a supposedly normal remaining kidney, I decided to and did in fact transplant the ureter to the intestine. It didn't look quite normal, but I felt no concern about it until the pathologist reported very extensive tuberculosis in the remaining ureter. Five years afterwards, however, the patient is alive and comfortable, so I do not feel perfectly sure that even in the presence of an infected kidney on the other side one is not justified in doing a transplantation, because I am satisfied

that one may easily contribute to a considerable, perhaps prolonged period of comfort by so doing.

DR. ARTHUR B. CECIL (Los Angeles): Would there be any possibility of the bowel becoming tuberculous from such transplantation?

DR. CABOT: I have assumed that there was a certainty of it but there is no evidence of it.

DR. A. RANDALL (Philadelphia): In regard to the anomalies of the ureter, I am reporting a case of symptomless fusiform dilatation at the lower end of the left ureter. This man was sent to me in 1924 because the insurance company had found pus in his urine. He was the most unusual, finely developed, robust chap one would want to see, was a nationally known oarsman, and had no history of any trouble at any time in his past life. I found an infected prostate and proceeded to give him a course of massage. Things cleared up and that made me suspicious of my diagnosis. On examination I found pus and a pure culture of tubercle bacillus on the left side.

(Slide) I found a peculiar fusiform dilatation at the lower end of the ureter. Ureter catheterization and lavage was carried on. The patient, all the time being symptomless, was not very much interested in this repeated cystoscopic maneuver and so discontinued his treatment.

Going into the history, on close questioning, the patient recalled he had had at the age of fourteen an abdominal cramp. It could perfectly well have been an intestinal upset as well as possibly a renal colic, but everything else being negative he has resisted treatment and now, seven years later, remains fairly well. The only thing I now find against him is that he has 12 per cent function on that side as against 22 per cent on the opposite side.

DR. WILLIAM E. LOWER (Cleveland): Two years ago I saw with Dr. Jolson, who I believe has reported it, a case of anomalies of the ureter in which there is double kidney, double ureter and two ureters emptying anterior to the sphincter muscle producing incontinence, in a young girl. Dr. Jolson had found the ureter in

the urethra and by doing a ureterogram found an enormously dilated ureter and a lot of pus, with a perfectly normal ureter on the opposite side. Believing this was a pyonephrosis, he did an operation and removed the ureter and discovered that the lower half of the kidney was apparently normal. The symptoms were not entirely relieved and later he discovered the other opening in the urethra and a large, dilated ureter. I then resected the upper part of the remaining kidney and that relieved the patient of her symptoms. She therefore had double ureters and pyoureters and the two ureters emptying into the urethra. Those emptying into the bladder were perfectly normal, but unfortunately one kidney was sacrificed before the diagnosis could be made, although the patient has been doing very well with the part of the remaining kidney that she had left.

Relative to the difficulty of taking care of these adherent ureters, I will relate an experience that I had some years ago, in which I tried to remove a stone from the ureter which was very adherent over the iliac vessels. There had been a long history of inflammation. The ureter was very tightly adherent and I undertook to detach the ureter so I could bring it up and more readily remove the stone. In doing so I tore the iliac vein, and the lesson to be drawn from that, as far as I am concerned, is to carry the operation to the ureter instead of trying to bring the ureter up into the wound in these very adherent cases.

DR. JOHN H. NEFF (University, Va.): I thought it might be of some interest to show the slides of a diverticulum we had, to which Dr. Bugbee referred.

(Slide) This was a man who had had intermittent kidney colic for some fifteen or eighteen years. Due to this diverticulum which you see coming here, he had a hydronephrosis above it, good function on this side and no infection on this side.

(Slide) This is a diagram of the operative findings. This diverticulum came in almost to the midline and was essentially of that type.

(Slide) After removal the diverticulum was taken off the ureter and to this point of restriction had the same make-up as regards thickness, and so on, as the ureter itself, but distally here it thinned down to quite a sheer membrane. It stretched out a

bit. From the tip to the point of connection with the ureter, the diverticulum had a length of 13 centimeters. The patient had complete relief of his kidney colic for about twelve to fourteen months. Since then he has had increasing recurrence of pain but has been quite unwilling to have any further investigation to find out just what is going on, partly due to the fact that he has undergone some mental deterioration. Whether that is due to fear of cystoscopy, I do not know.

DR. GEORGE R. LIVERMORE (Memphis): I would like to report a case of diverticulum of the ureter in the left lower ureter which was very much like that shown in the plate by Dr. Neff, only it was a little lower down than that, in a young man twenty-four years of age, who had an acute attack of ureteral colic. His local physician found a few blood cells and pus in the urine and he was sent to me for an examination. A pyelogram and a ureterogram were made and this diverticulum appeared. The patient has never had any more colic; it has been four years since the examination and he refuses any operative procedure. He comes in occasionally and only twice in the four years have I ever been able to get into the kidney; the other times the catheter has coiled up in the diverticulum and by passing several catheters I failed to make one pass up the ureter. I have never been able to find that opening. The man is quite comfortable; he has only a few blood cells in his urine, and he will not submit to any operation.

DR. EDWIN DAVIS (Omaha): Referring to Dr. MacKenzie's paper, I wish merely to mention the diagnostic sign in ureteral tumor, which I haven't seen mentioned in the literature.

The patient was a man of seventy, complaining of the sole symptom, hematuria. The diagnosis of ureteral tumor was based on the fact that blood was seen coming from the right ureteral orifice, whereas through a catheter passed immediately thereafter to the right renal pelvis, clear urine was obtained. This diagnosis was later confirmed by a ureterogram and ureterectomy.

DR. HERMAN L. KRETSCHMER (Chicago): I was very much interested in the group of cases that Dr. Bugbee reported and the one case that Dr. Crenshaw reported. These cases of diverticulum,

I think, are exceedingly interesting from a speculative standpoint and will be interesting from the standpoint of frequency.

We have three cases now under observation, one an autopsy specimen in a little child, as I remember the age, six or eight months old, in which the diverticulum is bilateral and it runs up from the inside much as did the specimen that Dr. Crenshaw showed in his case, with the exception that in the autopsy specimen the diverticulum is much longer. Having this type of specimen in a newborn, practically, it would seem reasonable to assume that that type is the congenital type. The type that Dr. Rathbun showed I think might possibly be the acquired type.

The second case concerns a patient who was sent in with a diagnosis of stricture of the ureter, with the request that he have dilatation. A pyeloureterogram was made from below and showed no evidence of stricture that we could determine, but a diverticulum of his ureter filled up.

The third case concerns a woman who had had many pelvic operations in the hands of gynecologists and two bladder operations because of bladder symptoms. The cystoscopic examination showed on one side a double ureter and double kidney pelves. Pyelograms were made and showed these to be practically normal. Cultural studies showed some pus cells and bacteria, so the patient was given a course of pelvic lavage. In spite of the fact that her infection cleared up, mild though it was, she still complained of backache, which I believe was not due so much to her urinary tract disease as it was due to a spinal arthritis. When selectan came out we made an intravenous injection of uroselectan, and, very much to our surprise, a large diverticulum was found in the pyeloureterogram. We then checked the other patient who had a diverticulum that was demonstrated from below and we were not able to fill that one with the selectan, so that it is possible that in a certain group of cases selectan may help us pick up some of these rather rare anomalies.

I was much interested in the anomalous insertion of the ureter. I think we all appreciate the fact that very frequently they are associated with double kidneys and anomalies of that type, but abnormal insertions of the ureter without these anomalies are very uncommon, as you know. I would like to mention briefly a patient, a woman who had both ureters inserted in her urethra with-

out double kidneys and without a double kidney on one side or the other; in other words, a woman with normal kidneys, without reduplication, and insertion of her two normal ureters in her urethra.

DR. JOHN L. CRENSHAW (Rochester, Minn.): I probably did not emphasize the fact in my paper especially but it seems of interest that in this case of ureteral diverticulum all of the patient's symptoms were due to infection, and that infection or evidences of infection in the urogram were all on the opposite side. One would naturally suppose that there would be some obstruction or constriction in the region of this diverticulum. As far as we could demonstrate, there was none, and all of the infection and dilatation were in the opposite kidney and ureter.

DR. ALEXANDER R. STEVENS (New York City): I have some slides which I would like to show concerning these two patients that I spoke of. These are urograms made by uroselectan.

(Slide) This is the first case of the girl made one year after operation. Her ureter, in the part exposed, was eight-tenths of a centimeter across. I think it is clear that there has been some increase in dilatation.

(Slide) This slide was made four weeks after operation. This individual had a ureter two centimeters in diameter and I think this picture indicates about as much dilatation as one would expect.

I tried to make it clear that I would not feel justified in transplanting a ureter which was giving forth pus and tubercle bacilli. In this first case I was able to catheterize and got clear urine. In the second case we couldn't catheterize but we got a very large output of phthalein, which I think excluded advanced tuberculosis, and the urine at the time of operation did not contain any pus.

DR. HUGH CABOT (Rochester, Minn.): Did you have a pathological examination of the section of the lower ureter that you transplanted?

DR. STEVENS: I did not, in either case.

DR. CABOT: I suspect that you may find tuberculosis in the lower ureter in those cases without tuberculosis of the kidney.

DR. DAVID W. MACKENZIE (Montreal): In our reports I did not go into the details to show the slides, to show the close resemblance between the mother and the daughter and Dr. Rathbun's history of his case which was also included. But I would like to offer as a suggestion the question of animal experimental transplantation of the ureter and its failures, which every clinic seems to report. Clinically every one of us seems to have had extraordinary success. It really is wonderful how these patients will do with the ordinary transplantations for exstrophies and for bladder pelves that have had bladder neck and sphincter destroyed.

Regarding the transplantation, as Dr. Cabot has referred to it, of the one kidney of the tuberculous patient who has lost a kidney and then has this oversensitive bladder, nobody wants to see these patients come, but we have to do something and we send them to a sanitarium for a year. They come back and say, "What are you going to do next?" We try this, that, and the other thing. Two or three years ago we transplanted a ureter in a single kidney and the patient did very well. The ureter where it was transplanted, as Dr. Cabot said, was definitely tuberculous; there was no question about it. Just two days before I left home I saw a young boy who has had surgical tuberculosis practically all over his body. He has had a bone removed, tendon removed, bursa removed, both epididymi, one kidney which I removed myself about fourteen years ago (he is now twenty-eight). For the last few years he has had bladder frequency and pain; he has been in bed for a year in a sanitarium at my own request and at the request of others. In desperation the other day we transplanted the ureter. The kidney is involved; at least, I thought it was. In the upper pole one could definitely see a lesion. The ureter looks all right. I have not had the pathological report, but I think there is some life in these dreadful cases. As Dr. Cabot said, wisely, when we operated on our first one we were sure of an extreme enteritis. It did not materialize. We don't know what will appear with this one.

DR. EDWARD L. KEYES (New York City): Unfortunately I was called out and missed a good deal of the discussion. You will therefore pardon me for omitting to answer questions, if I do not answer some that were brought up while I was out of the room.

I have been asked, however, to make it clear that in the second case I reported, the one of pyo-ureter that was finally drained through the vagina, there was no question of diverticulum. When I opened the pyo-ureter into the bladder and subsequently after the closure of that opening opened it into the vagina, fluids could be squirted freely to and fro, instruments passed to and fro, and the finger put into the ureter as far as it would reach upward toward the fistula into the groin.

ANTIVIRUS THERAPY IN COLON BACILLUS INFECTIONS OF THE URINARY TRACT

VINCENT J. O'CONOR, M.D.
Chicago, Illinois

Chronic colon bacillus infections of the urinary tract are, in the main, due to three conditions: persistent focal distribution of bacteria to the urinary organs; improper urinary drainage, and inability of the tissues to rid themselves of the invading microörganisms after they have once become infected. The latter may be called a lowered or insufficient immunity.

Modern methods of treatment, which include the recognition and elimination of all sources of focal infection and the continuance or re-establishment of adequate urinary drainage, have effected a prompt or gradual sterilization of the urine in a large percentage of these instances. A still appreciable number of these patients, however, have a persistent colon bacilluria with or without marked pyuria, and with symptoms of varying degree, which continues or recurs at frequent intervals despite all methods of treatment.

In the absence of demonstrable focal infection and with normal urinary drainage, the persistence of colon bacilli in the urine can most readily be explained by lowered resistance or lack of local tissue immunity to this specific organism.

Our attempts at therapy in this type of problem must be directed toward measures which will result in some specific stimulation of the infected tissues which will destroy the bacteria by the response of natural immunizing reactions.

Since the work of Besredka,[1] at the Pasteur Institute in Paris, increasing interest in the development of specific immunity has been aroused. His method of obtaining what he terms an antivirus by the filtration of the broth in which bacteria have grown until attenuated or dead, while open to some criticism, merits our consideration as an added means of rational therapy in chronic infection of the urinary tract.

I cannot in this paper review the rapidly increasing literature, experimental and clinical, on antivirus treatment. I merely wish to

present for consideration a personal experience of eighteen months' duration in the use of antivirus injections as an adjunct in the treatment of chronic colon bacillus infections of the urinary tract.

Legueu,[5] Heitz-Boyer,[2] Le Fur,[3] Mazeran[8] and others have been using broth-containing antivirus as a local injection or instillation into the bladder, urethra and renal pelvis for some time. In many instances they claim beneficial and curative results.

It was originally impossible to procure colon or mixed colon-staphylococcus-streptococcus antivirus broth in this country. The former was first furnished to us at our request by Dr. Joseph Biehn, bacteriologist of the Dermatological Research Laboratories at Chicago. The product was derived from cultures of colon bacilli obtained from the urinary tract of patients and from mixed stock cultures, and appeared to comply in every way with the Besredka requirements.

I first selected seven women with persistent colon bacillus pyelitis and cystitis who had been under observation for several years and who had no urinary stasis and no evidence of persisting focal infection. Repeated and frequent instillations of from 5 to 8 c.c. of the broth into renal pelves and bladder were carried out according to the technic described by the French urologists. After three months of intensive treatment, no beneficial effects were noted in six patients but a marked improvement resulted in one. In the latter patient a persistent pyuria, urinary frequency and dysuria all disappeared but the colon bacilli persisted on culture of the urine. This condition has been maintained for fourteen months without further treatment. At this time I selected ten cases of chronic prostatitis without evidence of focal infection and with sterile cultures of the upper urinary tract in patients whom I had treated by prostatic massage, urethral instillations, sounds, urinary antiseptics, and so forth, for over one year without appreciable improvement. In each of these I continued prostatic massage at five-day intervals, followed by a posterior instillation of 10 c.c. of colon antivirus broth. No other treatment was given. Eight of these men showed no marked improvement after three months. Two had spectacular results following the first treatment and continued to improve to the extent of a clinical cure in from six to eight weeks. The latter two have remained well.

These results were not sufficiently encouraging.

Following the work of Corbus with a somewhat similar substance in the treatment of gonorrhea by intradermal injection, and recognizing the rationale of this route for specific immunization through stimulation of the reticulo-endothelial system as shown by Cannon and others, the antivirus was next given by intradermal injection.

Weekly injections were given, starting with 0.1 c.c. and increasing by a similar dose up to 1 c.c. In each instance the injection is given at a widely distant place in the skin to avoid an Arthus' phenomenon (sloughing). The reaction is local, the area of injection becomes red and swollen for forty-eight hours with some local tenderness. Generalized reaction is absent.

Twenty-two patients, eight male and fourteen female, with pyelocystitis, were so treated. In fourteen there was no improvement; in three there was moderate benefit, and in five the results were spectacularly successful.

Sixteen patients with chronic prostatitis were so treated, with marked benefit in seven. All of these patients had been under my observation for more than a year and had previously failed to respond to all of the usual measures of treatment.

Some of these results are so gratifying that I wish to report the case histories in detail.

Case 1.—Mrs. N. K., aged forty, consulted me in March, 1924, complaining of right lumbar pain, frequency of urination and intermittent chills and fever for four years.

Examination showed chronic tonsillitis, right calculous pyonephrosis, chronic cystitis, left pyelitis and marked ulcerative endocervicitis. Blood urea introgen was 10.5 m.mg. per 100 c.c. There was a profuse growth of colon bacilli from either kidney, and complete functional destruction of the right kidney. There was normal p.s.p. and heavy indigo-carmine output from the left kidney.

On April 12, 1924, the right kidney was removed together with the upper two-thirds of a thickened, dilated right ureter. There was marked perirenal induration and it was necessary to leave the clamps on the renal pedicle. The patient recovered nicely and left the hospital with the wound completely healed, on April 28. The excised kidney was a pyonephrotic shell containing twenty-two stones. There was no evidence of tuberculosis.

During the next two months, the patient's weight increased from 140 pounds to 165 pounds and her general health was excellent. A marked pyuria with colon bacilli in profusion persisted, however.

The tonsils were removed in August, 1924, and four devitalized teeth in September, and a partial amputation of the cervix was done in November of the same year. The patient continued to gain in weight to 182 pounds. Blood urea nitrogen, in May, 1925, was 12 m.mg. per 100 c.c. Two hour and ten minute p.s.p. elimination was 60 per cent. Blood pressure was 115/90. Urine continued heavy with pus and colon bacilli. There were no urinary symptoms. Bladder capacity was 500 c.c. The patient's bowel elimination had always been normal and there was no evidence of any intraperitoneal focus of infection.

From May, 1925, to October, 1929, the patient was given twenty-eight cystoscopic treatments with various medication to bladder and left renal pelvis. The pyuria and colon bacilluria continued without improvement. She also took by mouth, for prolonged periods, nearly every form of medication designed as a urinary antiseptic, but without result. Attempts at improving her general resistance included long periods of rest and sun baths in Florida and Arizona and the copious drinking of water at several American springs.

From October, 1927, to March, 1928, the patient was given some sort of vaccine treatment by another physician. In October, 1929, she felt well, had normal blood count and blood chemistry, negative X-ray and normal pyelogram, but a urine thick with pus and yielding only colon bacilli on culture. There was no ulceration of bladder, no residual urine and no apparent residual infection in the stump of the right ureter.

In October and November, 1929, I instilled 5 c.c. colon antivirus broth into the left renal pelvis once a week for eight weeks. There was no particular change in the character of the urine, which remained foul-smelling and very turbid. On December 12, 1929, I injected intradermally 0.1 c.c. colon antivirus broth, December 19—0.2 c.c. and December 27—0.4 c.c. There was no general or urinary reaction, no rise in temperature. Merely a redness and swelling at the site of injection.

On January 3, 1930, the patient stated that for the first time in ten years her urine did not have a foul, ammoniacal odor. To my surprise, the catheter specimen of urine was practically clear and contained only 25-50 pus cells per field as compared with a complete coverage before. Weekly injections were continued as follows: January 3, 1930—0.6 c.c.; January 10—0.8 c.c.; January 17—1 c.c.; January 24—1 c.c.; January 31—1 c.c. At this time the urine was absolutely clear, only a rare pus cell could be found in the centrifugalized specimen and there was no growth on culture. Cultures and analysis were repeated frequently for several months with normal findings.

On May 12, 1931, culture was negative and there were 2 to 3 pus cells per high power field in the sediment. The urine has therefore remained free for seventeen months following the course of intradermal injections.

Case 2.—Mrs. F. W., aged thirty-seven, consulted me in October, 1927, because of foul-smelling urine and intermittent attacks of frequency and dysuria.

Her general health was excellent. Tonsillectomy was performed in 1921, appendectomy in 1916. Her present complaint began in 1925, but at no time had the distress been acute. There had been no backache, no history of chills or fever. Six months before I saw her, she had had all her teeth removed on the advice of a physician. She had also taken various urinary antiseptics by mouth for two years, nonprotein diet for six months, milk diet for three months.

On examination, there was no evidence of focal infection. Blood pressure was 120/85, blood count was normal, blood urea 15.6 m.mg. per 100 c.c. The urine was heavy with pus and gave a pure growth of colon bacilli on culture. On cystoscopic examination, the bladder was essentially normal except for hyperemia of the trigone; no stone, tumor or diverticulum, no residual urine. Ureters were easily catheterized and purulent urine from each contained colon bacilli. Dye excretion was normal from each kidney. X-rays and pyeloureterograms showed normal outlines.

Between October 12, 1927, and October 23, 1929, the patient had twenty cystoscopic treatments with various medication instilled in the renal pelves. After each treatment, there would be a considerable improvement with a gradual recurrence of the previous condition in two or three weeks. In October, 1929, her condition was the same as two years previously. General health good, no symptoms other than occasional bladder irritability, but a marked pyuria with foul-smelling urine. Weekly injections intradermally of colon antivirus broth until four 1 c.c. amounts had been given was followed by a complete clearing of the urine of pus and colon bacilli and from January 15, 1930, to May 12, 1931, the urine has remained sterile and without odor or sediment.

Case 3.—Mrs. P. W., aged thirty-two, came in August, 1928, complaining of recurrent attacks of bilateral backache, chills and fever and frequency and dysuria since an acute enteritis in Havana in 1921. Tonsils were removed in 1919. There had been no recurrent head colds or sinus infection.

Teeth were normal on X-ray, none devitalized. General examination was negative. Blood pressure was 125/85; blood count normal. Urine was cloudy with pus, colon bacilli on culture. Cystoscopic examination showed diffuse cystitis, bilateral renal infection, negative X-rays with normal pyelo-ureterograms. There was a normal dye excretion from each kidney, and blood urea nitrogen was 12 m.mg. per 100 c.c.

The ureters were dilated to 10 F. and silver nitrate, mercurochrome, et cetera instilled in the renal pelvis on occasions up to March, 1929. During this time, the patient had four acute attacks of pyelo-cystitis

with chills, fever and increased pyuria. On March 13, 1929, colon antivirus broth was given intradermally and weekly injections as described before were continued until four 1 c.c. amounts were given. The urine became sterile after the fifth injection and for the past thirteen months there have been no recurrences. On April 25, 1931, the urinalysis was normal and cultures negative.

Case 4.—S. A., aged twenty-five, consulted me in May, 1930, complaining of frequent urination, every hour during the day, four to five times each night. There was no other complaint. Suprapubic resection of a large vesical diverticulum had been done elsewhere in 1925. The operative recovery had been rapid and satisfactory, but pyuria and frequent urination persisted. Weekly bladder lavage, prostatic massage and medicine by mouth had been continued by his surgeon for fourteen months after operation, but without improvement. He had not seen a physician for three years until denied life insurance because of a marked pyuria. He had become reconciled to the urinary frequency.

Complete physical examination revealed no apparent focal infection; blood pressure was 120/80, blood count normal, blood urea nitrogen 13.5 m.mg. per 100 c.c. Urine was turbid with pus and shreds and yielded colon bacilli on culture. Prostatic strippings contained only 3 to 5 pus cells as checked on several occasions. There was no urethral stricture and no residual urine. Cystoscopic examination showed no vesical neck obstruction, excellent healing of previous diverticular region and no stone, tumor or other diverticulum. The bladder capacity was 100 c.c., and on inspection there was a diffuse hyperemia of trigone and lateral walls. The urine from each kidney was clear, contained only a rare pus cell and was negative to culture on two occasions. X-rays and pyeloureterograms showed normal outlines. Attempts at increasing bladder capacity by hydrostatic pressure using 1-5000 solution of silver nitrate gave no improvement although persisted in weekly for two months; twice under anesthesia. Repeated tests for acid-fast bacilli were negative, including one guinea-pig inoculation.

In July, 1930, intradermal injections of colon antivirus broth were given, starting with 0.1 c.c. After the third injection of 0.4 c.c., slight improvement was noted. Through an error, the fourth injection instead of being 0.6 c.c. was 1 c.c. There was no systemic reaction, but within two hours marked frequency, urgency and urinary tenesmus occurred. Terminal hematuria and persistent desire to void continued for thirty-six hours. There was no chill and no elevation of temperature. One week later, the urine was clear, the bladder capacity was 300 c.c. and the patient slept through the entire night without voiding. There was no reaction to 0.4 c.c. injection on that day or to subsequent injections, which were terminated after four 1 c.c. doses.

Since August, 1930, the urine has remained sterile, bladder capacity is 350 c.c. and there is no dysuria or frequency. Two life insurance policies have been issued, without increased rate, during the past four months.

Case 5.—Mr. C. J., aged forty-five, with negative venereal history, first appeared in May, 1926, complaining that he had had a prostatic infection for ten years. He had been treated intermittently by competent urologists during this time. General examination was normal. Tonsils were somewhat hypertrophic, teeth normal.

Urine contained shreds, small amount of pus and colon bacilli on culture. There were 100 to 200 pus cells per high power field in the prostatic and vesicular strippings. This fluid also contained a profusion of colon bacilli with some staphylococci and mixed organisms. He had previously received cystoscopic examination three times and was told that the infection was limited to the prostate. At my suggestion, his tonsils were removed in January, 1927. For two years, I treated him at weekly or monthly intervals by prostatic massage and posterior urethral instillations of argyrol or weak silver nitrate solution. He was more comfortable after these treatments but fatigue, liquor, sexual excitement and the like always resulted in an exacerbation of symptoms and an increase in the pus content of the prostatic strippings.

In January, 1930, after an unusually severe prostatitis, I again cultured his urine after prostatic massage and obtained a profuse growth of colon bacilli and scant staphylococci. Colon anti-virus broth 0.1 c.c. by intradermal injections increasing each week until five 1 c.c. doses were given resulted in almost unbelievable improvement. Shreds disappeared from the urine, the latter became clear and sterile and the pus cells after stripping decreased to 8 to 12 per field. Of more interest to the patient was the fact that he had no discomfort and that prolonged excise, alcoholic drinks, and so on, brought about no local irritation or shreds in the urine as had previously been the case for some twelve years. This condition has continued and, other than an occasional prostatic massage, the patient has had no further treatment.

It can be seen from the detailed résumé of such instances as those described that, despite the fact that antivirus therapy has not aided in a large percentage of cases in which it was used, a certain amount of enthusiasm is permissible.

CONCLUSIONS

In patients in whom all corrective measures have failed to eliminate the colon bacillus from the urine, *i.e.*, removal of foci of infection, determination of normal urinary drainage and failure of local response to repeated ureteral catheterization, renal pelvis

lavage, ureteral dilatation, and so forth, intradermal injections of colon antivirus may be employed with the possibility of increasing the individual immunity in a certain percentage of instances.

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STUDIES ON THE SECRETION OF THE PROSTATE GLAND

I. A METHOD FOR COLLECTING THE PURE SECRETION IN THE DOG
II. FACTORS INFLUENCING THE SECRETION OF PROSTATIC FLUID
III. SOME OF THE PROPERTIES OF THE PROSTATIC SECRETION OF THE DOG

JAMES I. FARRELL, Ph.D., M.D.†

From the Cleveland Clinic Foundation, Cleveland, Ohio

In an attempt to study the physiology of the prostate gland, the difficulty of securing prostatic secretion uncontaminated with the secretion of the seminal vesicles and urine was encountered. A review of the literature on studies of prostatic secretion failed to reveal a satisfactory method. Most of the papers on prostatic secretion were found to be studies of the seminal fluid or of specimens collected by massage of the prostate gland and the seminal vesicles in the human, and none of the authors could be absolutely sure that he was dealing with pure prostatic secretion. In order to study the secretion of the prostate gland from day to day in the same animal, it was necessary to devise a fistula method which would yield a pure secretion over an extended period of time.

I. A METHOD FOR COLLECTING THE PURE SECRETION IN THE DOG

Among the common laboratory animals the dog is known to have no seminal vesicles, the vas deferens ending directly on a small hillock in the posterior urethra. The prostate gland is a compact structure surrounding the posterior urethra about 2 cm. distal to the vesical neck. The gland is easily accessible for massage with the finger in the rectum. For these reasons and also because in the male dog the body of the bladder lies in the abdominal cavity just above the penile portion of the urethra, the dog was chosen as the most suitable animal for our experiment. Dogs from two to four years old were used because it was found that they have a larger prostate gland and yield more secretion than do younger animals.

†George Belcher Fellow in Urology.

The principle of the operation for establishing a fistula of the prostate gland is as follows: (a) the bladder is separated from the posterior urethra; (b) a fistula is made between the body of the bladder and the penile sheath for the urine to drain to the outside; (c) at a second operation the proximal end of the urethra is opened in the perineum, making a fistula to the prostate gland. This produces a fistulous tract of the prostatic urethra into which pass the secretion of the prostate gland and the secretion of the epididymis

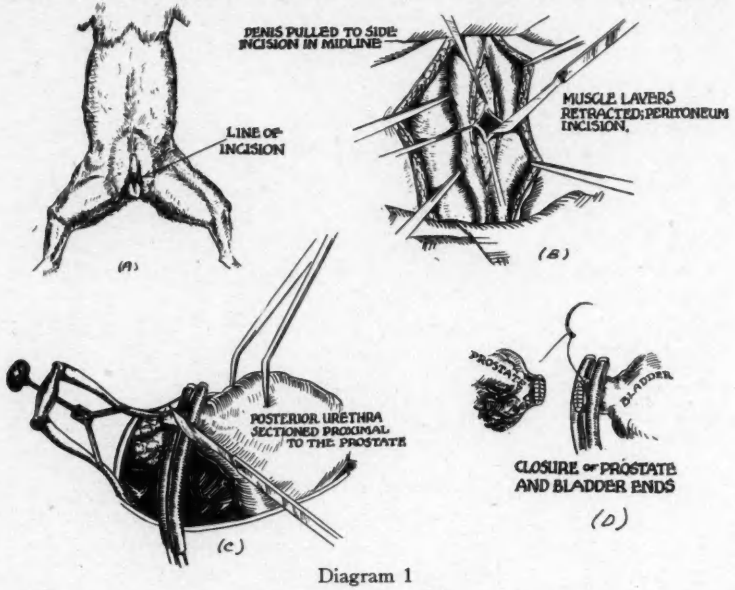

Diagram 1

and testicle and from which the prostatic secretion can be collected. The secretion obtained from the testicle and epididymis can be prevented from entering the prostatic urethra by means of ligation of the vas deferens. This was done in a few animals and did not affect the amount of secretion in any way. The secretion of epididymis and testicles can be ignored in these experiments, as no sperm were found in the prostatic secretion obtained by massage.

Operative Procedure

Under morphine-ether anesthesia the abdomen and external genitalia are shaved and prepared with ether, iodine and alcohol, care

being taken to remove all the iodine as the tissues in this region burn rather easily. The penile sheath is irrigated with silver nitrate solution in a strength of one part in 2,000 of water.

A longitudinal incision is made through the skin and subcutaneous tissues just lateral to the penile sheath. If this is done with care the larger vessels can be avoided (*A* in Diagram 1). The penile sheath is retracted toward the midline, and the abdomen is opened through an incision in the linea alba (*B* in Diagram 1).

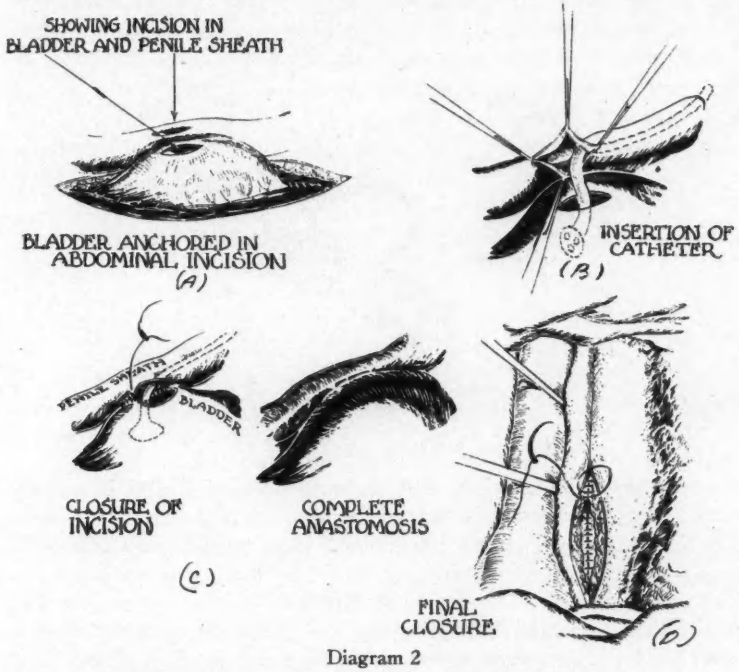

Diagram 2

The small intestines are pushed into the upper abdomen with gauze tapes in order to have better access to the genito-urinary organs. The bladder is then grasped with forceps (*C* in Diagram 1), and drawn up into the wound; the division of the lateral ligaments of the bladder facilitates this procedure. When the bladder is drawn up sufficiently, the posterior urethra surrounded by the prostate gland comes into view. A small intestinal clamp protected with

rubber is placed on the bladder neck, care being taken not to include the ureters or vas deferens. A second clamp is placed on the posterior urethra just proximal to the prostate gland. The posterior urethra is divided between the clamps. The cut end of the bladder neck is closed with a triple naught chromic catgut continuous suture, and reinforced with interrupted sutures. The cut end of the posterior urethra is likewise closed with a continuous suture of the same material (*D* in Diagram 1).

The uppermost portion of the fundus of the bladder is brought up into the abdominal incision (*A* in Diagram 2) and the abdomen closed with the fundus portion of the bladder securely anchored in

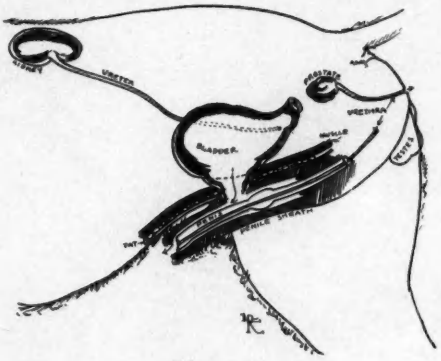

Diagram 3

the middle of the incision. The under surface of the penile sheath which lies directly above the abdominal incision is now opened. The bladder is opened at this point and a mushroom catheter is placed through the penile sheath into the bladder (*B* in Diagram 2). The opening in the bladder is anastomosed to the opening in the penile sheath (*C* and *D* in Diagram 2). The subcutaneous tissues are closed with a continuous catgut suture and the skin closed with a subcuticular stitch. The catheter is allowed to remain in the bladder for four days, and is then removed.

About one week following the above procedure a perineal urethrotomy is done. The urethra is divided, the distal portion being tied off, while the proximal end leading to the prostate gland is sutured to the skin, thus making a fistula leading to the prostate gland. For the purpose of illustrating the completed operation

Diagram 3 is shown. The ease with which the prostatic secretion can be obtained may be appreciated.

Results

This operation has been done on eight dogs. Six of these dogs are living and well, with no evidence of urinary disturbances. Two dogs died from pyelocystitis about three weeks after the operation. In the living dogs the urine drains from the bladder into the penile sheath, and thence to the exterior. This type of cystostomy is much better than one opening directly into the skin. When a cystostomy opens directly on the skin, the urine tends to excoriate the skin. When the bladder opens into the penile sheath, the urine flows over mucous membrane, which is resistant to the action of the urine. In addition the bladder does not open directly on the skin and the possibility of an ascending infection is less.

When the perineal wound had healed, the prostate gland was massaged with a finger in the rectum and from 1 to 2 c.c. of prostatic fluid could be obtained from the perineal fistula.

In order to know whether or not any of the secretion obtained by massage might come from other places along the urethra, a prostatectomy was done in one of the animals. In this animal massage of the posterior urethra failed to produce any secretion. Therefore we can conclude that all of the secretion comes from the prostate gland.

This operation affords an excellent opportunity to study the secretion of the prostate gland, in that it permits experiments of a "chronic nature" to be carried out. The above described preparation was used in the following investigation.

II. SOME FACTORS INFLUENCING THE SECRETION OF THE PROSTATE

Massage of the prostate gland caused about 1 to 2 cm. of fluid to flow from the perineal fistula. This yield was obtained when the dog was massaged only once a day. If the dog was massaged twice daily a smaller amount was obtained from subsequent massages on the same day. If the dog was not massaged for two or three days a slight increase in the amount of the secretion was noted, but in our experiments we never obtained more than 2.5 c.c. We have not been able to ascertain whether or not a continuous secretion occurs, as it is very difficult to keep a receptacle over the

fistula for a long period of time. It appears, however, that if there is a continuous secretion from the gland, it is very small in amount.

The response of the gland to several common drugs was tested. Atropine caused a dimunition in the amount of secretion. For example, dog number six was massaged at eight o'clock and 1.3 c.c. of fluid was obtained. The dog was then given one-fiftieth of a grain of atropine, and the secretion was collected at twelve o'clock. During the four-hour period the dog secreted only 0.3 c.c. of fluid, whereas the usual amount of secretion during that time was about 1 c.c. The same dog was given 0.3 gr. of pilocarpine several days later, and on being massaged two hours after the administration of the pilocarpine 1 c.c. of fluid was obtained. Adrenalin failed to cause any change in the secretion of the gland. It was given in doses of 1 c.c. of a 1-1000 solution subcutaneously, every hour for three hours.

Dog number eight was massaged and 1 c.c. of fluid was obtained. The dog was then exposed to a female in heat, but was unable to complete the act of coitus. Following a half-hour period of attempting coitus the gland was again massaged and 0.7 c.c. of fluid was obtained. This is a marked increase in the rate of secretion. Unfortunately this experiment could not be repeated because bitches in heat were not available at the time when other males could be used.

Cantharides has been used as an aphrodisiac, and 20 minims was given to dog six, and the dog was massaged two hours later. The dog showed no increase in libido, and the amount of secretion obtained was 0.2 c.c. Larger doses were not given as the possibility of the dog developing nephritis was feared.

III. SOME OF THE PROPERTIES OF PROSTATIC SECRETION IN THE DOG

The fluid obtained by massage was at times clear, colorless and watery in consistency. Occasionally the fluid was slightly turbid due to an increase in the protein content. The fluid was acid in reaction having a pH of 6.0 to 6.4. At no time was the secretion found to be alkaline. Even when the urine was definitely alkaline as the result of ingestion of sodium bicarbonate, the prostatic secretion remained acid in reaction. The specific gravity of the prostatic secretion varied between 1.008 and 1.027. The total solids on 1 c.c. dried at 100° C. averaged about 14 mg. per cubic

centimeter. The viscosity of the fluid as compared with distilled water was 1.1, a finding which indicates a viscosity comparable to that of water.

The chemical analysis of the fluid was made in an attempt to ascertain the composition of the fluid, but no attempt has been made to identify the nature of the proteins present.

Table 1 shows the content of the various substances estimated on the basis of milligrams per 100 c.c. of the fluid. The figures represent the averages of five or more determinations.

The possibility that the prostatic secretion contains some of the common digestive enzymes was investigated. It was found that the prostatic secretion contains no enzymes which can be determined by the ordinary tests. Five cubic centimeters of 0.1 per cent starch solution was not digested by a cubic centimeter of prostatic secretion in twelve hours. The prostatic fluid also failed to show any action on a solution of casein. No lipase could be demonstrated in the secretion.

TABLE I

CHEMICAL ANALYSIS OF THE PROSTATIC SECRETION IN THE DOG

Constituents	Average number of mgm. per 100 c.c.
Total nitrogen	140
Non-protein nitrogen	34
Urea	35
Creatinine	0.9
Chlorides (as NaCl)	900
Calcium	4.8
Phosphorus (total)	0.05
Glucose	17.0
Lecithin	none found
Cholesterol	none found

DISCUSSION

The fact that the specific gravity of the prostatic secretion is relatively low and the viscosity closely approximates that of water is quite surprising as this is contrary to the usual conception of the secretion. The acid reaction of the secretion in all of our tests indicates that this is the normal reaction of the fluid. Many observers have reported on the reaction of the prostatic secretion. In most cases, however, the fluid studied has been collected from human subjects and is of course contaminated with seminal fluid.

Iversen (1874), Pezzoli (1902), Casper (1903), and Muschat (1926), working on the secretion from clinical cases found the reaction of the seminal fluid to be alkaline. Furbringer (1886) found that the seminal fluid secretion in man is amphoteric or weakly acid; Steinach (1894) corroborated Furbringer's work. Lohnstein (1900) tested the seminal fluid from 500 patients and by titration methods found the secretion to be acid. Redenz[8] working on the ox stated that the titratable alkalinity and the pH of the prostatic fluid was higher than that of the seminal vesicles and testes, which indicates that all the secretions in the ox are alkaline.

In all of our tests, which were made from five to ten minutes after the specimens were collected, the reaction was always definitely acid. This acidity was not due to infection, as cultures taken at the same time showed the secretion to be sterile. We have no explanation for this apparent contradiction of the literature concerning the reaction of the fluid, although it may be possible for the reaction to vary according to the time of collection and the number of sperm or the amount of vesicle fluid present in the samples collected by previous workers. McCarthy et al (1928) have shown that the incubation of the sperm for a period of time tends to cause an elaboration of lactic acid, which in their experiment did not affect the acidity or alkalinity, since the seminal fluid appeared to have a very efficient buffer mechanism. Of course, the reaction of the secretion in different animals may vary.

The total protein was determined by calculating the difference between the total nitrogen and the non-protein nitrogen. The common factor of 6.25 for the nitrogen content of the protein was used as a factor for the conversion of the nitrogen figures into terms of protein. This gave the amount of protein as 662 mgs. of protein in 100 c.c. of prostatic fluid.

The urea content varied between 38 and 52 mg., and it is interesting to note that the concentration of urea in the prostatic secretion varied with the amount in the blood. This relation has been observed in other secretions such as gastric juice and saliva.

The total phosphorus was found to be surprisingly low. This finding was rechecked a number of times and the content was always found to be consistently low. It has long been supposed that the prostatic secretion contained much lecithin, which is a phospholipin. In all probability the lecithin is a product of the secretion

of the seminal vesicles. In order to check this supposition, the total phosphorus of the seminal fluid from a guinea pig was determined and found to contain 4.5 mg. of phosphorus per 100 c.c. This is greatly in excess of the amount found in the prostatic secretion in the dog.

The chlorides have a rather high concentration in the prostatic fluid. In a specimen of high specific gravity as much as 1,240 mg. has been estimated to be in 100 c.c., the average being 900. The lowest estimate of the chlorides was 440 mg. per 100 c.c., which was found after the injection of pilocarpine, the pilocarpine causing an increase in the amount of secretion obtained by massage.

The concentration of glucose in the prostatic secretion is surprisingly small. In this connection it is noteworthy that McCarthy et al[9] have found a very high concentration of sugar in the seminal fluid collected in condoms from patients. The average amount of glucose in these condom specimens was 250 mg. per 100 c.c. of seminal fluid. Here again a sample of seminal fluid was taken from the guinea pig and found to contain a high concentration of glucose. In one sample 576 mg. of glucose in 100 c.c. of fluid was found. Studies are now under way to learn something of the protein fraction.

SUMMARY

A new method for the collection and study of the secretion of the prostate gland has been described which makes it possible to obtain pure prostatic secretion at will from the dog. The dogs are not inconvenienced in any way by the urinary fistula.

The physical characteristics of the prostatic fluid show it to be acid, of a low viscosity and usually clear and colorless.

The common conception that the prostatic fluid contains large amounts of lecithin has not been found true in the case of the dog.

The concentration of the chlorides varies with the amount of the secretion obtained. When the flow was augmented by pilocarpine, the per cent of chlorides was found to be less.

The prostatic fluid is relatively poor in glucose.

None of the common digestive enzymes was found in the prostatic secretion, which leads one to believe that the prostate has no digestive function.

The secretion is augmented by the injection of pilocarpine, and

decreased by the injection of atropine. No change in the rate of secretion was observed with the use of adrenalin.

Sexual excitement causes an increase in the rate of secretion.

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TOOTHPICK IN THE URACHUS

CLYDE LEROY DEMING, M.D.

Department of Surgery, Yale University and New Haven Hospital, New Haven, Conn.

Foreign bodies within the bladder and urethra are common, but up to this time there have not been any references in literature to foreign bodies within the urachus of the child or the adult. The lesions of the urachus so far reported have been mostly inflammatory or fistulous in character and have been encountered in the newborn or early childhood. Recently a report of urachal tumors has been made by Begg.

The case here reported is of interest and of importance because of the unique condition, the unusual clinical picture, the difficult diagnosis, the associated infection and the complete recovery after surgical treatment.

CASE REPORT

Patient, A. A., a Hebrew, aged fifty-three, was admitted to the Urological Service at the New Haven Hospital on October 25, 1929, complaining of pain in the lower abdomen. The family history did not disclose any facts relative to the patient's illness.

His past history was one of unusually good health. He had a broken leg from an accident and had one attack of influenza. He also gave a history of a few minor attacks of rheumatism without any swelling of the joints or any particular incapacitation as to his work. He did not ever suffer from any headaches, dizziness or vertigo. His appetite had been rather poor for the past year and his bowels quite severely constipated; for which, he was accustomed to take many types of cathartics and often supplemented them with enemas in order to produce a bowel evacuation. Occasionally, he was accustomed to go as long as one week without a bowel movement. He had never noticed any blood or mucus in the stools. He did not have any symptoms referable to the heart and lungs, nor did he have any swelling of his hands and feet. His urinary history was one of frequent voiding as long as he could remember. He stated that he usually voided about every hour and a half during the day and about every three hours at night. The urine, however, was always clear.

His present illness dated back seven months, when he had an attack of what was thought to have been an acute appendicitis. He was

operated upon for this condition and the appendix removed; but during his convalescence, he noticed some pain in the lower abdomen. The pain continued in spite of the fact that his convalescence from the appendectomy was uneventful. The pain seemed to be fairly well localized in the lower abdomen above the bladder and more often on the right side than on the left. The pain was continuous except

Fig. 1. Photograph of drawing of specimen removed at operation showing navel above, toothpick in center of urachus and vertex of bladder below.

when he was lying perfectly quiet in bed. While walking around, he was always conscious of this dull pain. Any movement in the standing or lying position seemed to cause this dull pain in the lower abdomen. The pain never radiated to the upper quadrant or to the

external genitalia. In spite of his rather frequent urinations, he had never been treated for any bladder disturbance.

The patient was a very large man weighing about 230 pounds. The skin was rather pale and sallow but did not show any jaundice. The patient looked septic. The head, including the eyes and ears, was normal. The mouth disclosed a coated tongue and several decayed teeth. The chest was large, barrel-shaped and the lungs were resonant. The heart was normal in size and the pulse was 72. The blood pressure as 122/80. The abdomen was very large and symmetrical on inspection. Palpation revealed a mass between the navel and the pubis in the midline. This mass measured about 11x6 cm. It was fairly well outlined in spite of the thick adipose abdominal wall. The mass was slightly movable from right to the left but not up and down. Its surface was fairly smooth, regular and was quite sensitive to pressure. It did not reach to the pubis below, but seemed to be continuous with the navel above. The percussion note over the mass was dull. The remainder of the abdomen and organs were within normal limits. The external genitalia showed only slight atrophy of the testes. The rectal examination revealed a normal sphincter, prostate, seminal vesicles and posterior wall of the bladder.

In view of the fact that the mass seemed to be slightly movable within the abdomen and with a history of severe constipation, it was thought wise to subject the patient to a bismuth series. This was done with the result that the gastro-intestinal tract was found to be normal except for small diverticula noted in the sigmoid. A bismuth enema was then given which substantiated the former roentgenological impression.

The urine was grossly clear without any albumin or sugar, but microscopically there were a moderate number of pus cells and an occasional red blood cell without any evidence of organisms. The acid-fast stain was negative for tuberculous bacilli. The blood count revealed 4,800,000 red blood cells; hemoglobin of 98 per cent; 16,700 white blood cells; 65 per cent polymorphonuclear leukocytes; 30 per cent large monocytes, 4 per cent eosinophils and one per cent basophils. The phenolsulphonephthalein test showed 70 per cent for two hours. The Wassermann test was negative with two antigens.

Cystoscopy revealed that the urethra was rather small so that it was necessary to dilate the urethra before the cystoscope could be introduced. The bladder capacity was 290 c.c. without any evidence of residual urine. Study of the bladder mucous membrane showed in the vertex a small, smooth, button-shaped mass about 1.5 cm. in diameter elevated 0.5 cm. Its surface was quite red and slightly ulcerated although definitely covered with mucous membrane. There was no evidence of redness around this mass and no signs of infiltration. There was no evidence of fistula within the center of the nodular mass.

The ureteral orifices were normal and functioned clear urine. There was no evidence of prostatic adenoma. A diagnosis of tumor of the urachus was made.

On November 11, 1929, the patient was operated upon under gas oxygen anesthesia. A midline incision was made and the tumor exposed. Beneath the recti muscles and in the midline was found a tumor mass about 10 cm. in length and 6 cm. in width. It was quite

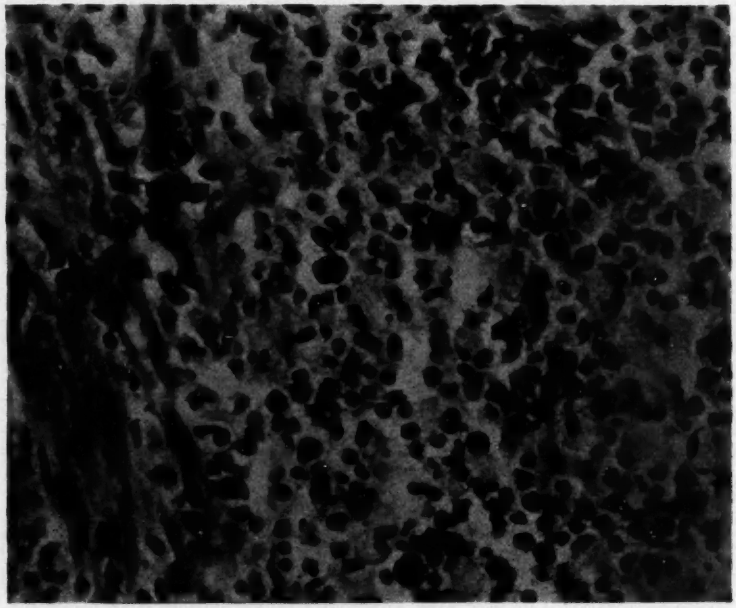

Fig. 2. Photomicrograph of section taken near the foreign body. M×550.

adherent to the under surface of the recti muscles; but was nearly surrounded with peritoneum and involved the navel above and extended down to connect with the top of the bladder by a small isthmus. The peritoneum was markedly thickened over the mass, although not adherent to the intestines. The excised mass included the navel above and the vertex of the bladder below. The bladder was drained and the wound closed in layers. The patient's condition remained satisfactory throughout the operation. The wound healed very well except for the upper angle of the incision, where there seemed to be a

continuous discharge of thin purulent material. The patient was discharged three weeks following the operation in excellent condition and with a normal urine.

The patient was seen in the out-patient department at regular intervals of a few days for six weeks but the sinus tract seemed to remain

Fig. 3. Photomicrograph of a section taken through the vertex of the bladder. M×45.

about the same. At the end of this time, the patient developed pain and some swelling in the right lower quadrant. There was considerable redness of the skin and definite formation of a mass in the lower right rectus region. The patient was again admitted to the hospital,

January 20, 1930, and an abscess of the right rectus muscle incised and drained. This healed very slowly and seemed to be resistant to various applications of antiseptics, but finally closed after a period of three months. The patient's condition at the present time is excellent one year after complete healing of the wound.

Pathological Note.—The specimen consisted of an inflammatory mass which was roughly cone-shaped, measuring about 15 cm. in length and 5 cm. in diameter at the base. On longitudinal section it showed a mucosal surface, at the base, which was said to be the fundus of the bladder. The bladder wall was much thickened, measuring 1.5 cm., and showed numerous concentric, fibrotic areas. Leading up from the fundus was a sinus tract which consisted of a narrow, necrotic central cavity, in which lay a toothpick, measuring 5 cm. in length. This could be freely moved in the sinus tract. Surrounding the necrotic area was a wall of dense, fibrous and fatty tissue with degenerating yellowish necrotic plaques and reddish areas of hemorrhage. About this necrotic sinus, and nearly continuous with it, was a definite fibrous structure, presumably the urachus, which ran to the umbilicus at the top of the specimen. The umbilical region was represented by a funnel-shaped piece of skin and a small strip of muscle below it. Microscopic sections were taken from the bladder wall and from the wall of the sinus tract.

Microscopic examination of preparations of the bladder wall showed transitional epithelium which was sloughed in some areas. The submucosa was thickened, edematous in appearance, and heavily vascularized. Small capillary loops were seen projecting upward to the epithelium itself. The fibrous tissue was scant and exceedingly vacuolated. Polymorphonuclear leukocytes and lymphocytes were abundant about the vessels and scattered through the interstitial spaces. The smooth muscle bundles were separated by areas or areolar connective tissue, which were infiltrated by wandering cells. Sections of the sinus tract wall showed a very dense, fibrous tissue which merged gradually into a surface area of active inflammatory tissue, with areas of necrosis. Plasma cells, polymorphs and lymphocytes were about equally abundant. The striking thing was the number of endothelial phagocytic cells, which showed vacuolated cytoplasm and occasionally an ingested erythrocyte or leukocyte. Fibroblasts and a few capillaries were seen growing into the exudate from the fibrous layer.

A culture from the abscessed cavity showed a pure growth of yeast. An attempt was made to study the type of yeast present, but it failed to grow on ordinary media and, furthermore, disappeared on special yeast media. The fact that this yeast would not grow on ordinary media would indicate that this organism was definitely pathogenic rather than saprophytic. The culture from the second operation was staphylococcuc aureus.

DISCUSSION

The point of interest with respect to this case is the portal of entry for the toothpick. The patient had denied previous to the operation that he had suffered any urinary disturbance at any time in his life. When shown the toothpick after the operation and asked if he had ever seen such an object, he replied that he carried a vest pocketful all the time and that these were made from the small bones of the legs of chickens and turkeys. He then recalled that when a school boy at the age of seven and nine, he use to have severe pains in the bladder and marked tenesmus on urination. The pains were often so severe that he was unable to walk home and his father carried him home on his back. He does not ever recall inserting the toothpick into the urethra, but it is assumed that the portal of entry was probably through the urethra at this early age and that the toothpick remained in the bladder for some time and was finally forced into the urachus. The other possibility, of course, is that the navel might have been the port of entry, although this is a mere guess, as the patient does not recall whether or not children's navels in Russia were cleansed with toothpicks and cotton and that accidentally it might have been forced into the urachus.

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DISCUSSION

DR. GEORGE G. SMITH: I should like to ask Dr. O'Conor what the method of preparation of this antivirus broth is; in other words, whether the preparation is such that a bacteriophage would have been killed, or not.

DR. WILLIAM E. LOWER (Cleveland): In discussing Dr. Farrell's paper, I would say that for some time we have been trying to see whether we might work out a method by which we could determine the probable factors which are responsible for the production of hypertrophy of the prostate gland. In order to do that thoroughly it is necessary to know more about the physiology of the prostate, so we put Dr. Farrell on the problem of working on the physiology of the prostatic secretion, and Dr. Johnson has been working with me in connection with some experimental work on the question of prostatic hypertrophy. We have found very definitely that the anterior lobe of the pituitary connected with the testes was responsible for the development of the prostate gland and the seminal vesicles; in other words, that if the testes are removed, the prostate atrophies and so does the seminal vesicle, but if the testicular hormone is injected it is immediately restored. So we first must know more about the physiology and then probably work out some way in which we can determine definitely what is responsible for the prostatic hypertrophy.

We have done, as you all know, what we believe to be very interesting work in the treatment of prostatic hypertrophy but that is not the solution of the problem. What we should know is why the prostate hypertrophies. Some inorganic salt may be responsible for it. We know that the thyroid has its iodine, the parathyroid its calcium, the adrenalin its magnesium, and recently it has been shown that manganese affects the sexual apparatus, so we are hoping that, by knowing more of the physiology of the prostate, we will be able to work out some solution for the prostatic hypertrophy. So far no reason for it has been advanced. We know that a low-grade chronic inflammation will increase the secretion of a gland. It might be then that some obstruction may

develop some hypertrophy. What we are particularly interested in is that by knowing more of its physiology and hooking up this tripod which is very necessary to the production and development of the gland, we may find out some particular cause for it. That is why we have asked Dr. Farrell to present this paper on physiology. I am sure it will set us all to thinking and will encourage us to work out some definite way of preventing it.

DR. VINCENT J. O'CONOR (Chicago): I did not go into the details in regard to the method of preparation of antivirus because it is somewhat of a long story and anyone who is interested can read the complete works of Besredka. There are now three volumes that have been published in the last five years coming from the Pasteur Institute. In brief, the preparation is that of a broth culture which is allowed to grow for various periods, sometimes until there is a complete sterilization of the culture by whatever these antagonistic substances are that develop in the liquid medium; then there is a filtration of the medium and the medium is sterilized. Of course, bacteriophage is not thermostabile and the antivirus is thermostabile; it can be sterilized with heat. Then the dilution or the standardization has been variously used as a dilution of 1 to 1,000 or 1 to 1,500. One to 1,000 has been the dilution in the material which I have used. Of course, this whole problem, from my point of view, is in somewhat of an experimental stage and I offer it to this Society in the hope that some of you will follow up the suggestion of working out some manner of increasing individual immunity in this type of patient.

You will note that I have refrained from using this therapy except in the very chronic cases where very careful and prolonged observation has been made and where all of the usual well-accepted measures have failed. The main point, however, in the work, of course, is the development of the specific immunity by intradermal injection. If this material is given subcutaneously it has no effect. It must be given intradermally so as to stimulate the so-called reticulo-endothelial system.

There is one more point I would like to suggest, along the line of the work of Besredka, in the application of wet dressings, and that is the application to these wounds of antivirus dressings, either mixed colon staphylococcus or streptococcus antivirus or a

pure colon. It is sometimes unbelievable how these wounds will clear up with these wet dressings, presumably from a local immunization of the tissue by absorption from the dressings. The colon bacillus, as far as I know, does not develop an exotoxin, so it differs from the staphylococcus and the gonococcus and probably the streptococcus. I think all of these have been fairly well proven to develop an exotoxin. In using the colon bacillus we are really using whatever these antagonistic substances are that have developed by the growth of the bacteria, probably an autolysin and possibly some other type of toxic product, so we are not really introducing colon bacillus toxin when we introduce this preparation.

DR. JAMES I. FARRELL (Cleveland): I do not believe that the prostate gland has any function in the general body metabolism but I do think that the prostate gland has a function in the metabolism of the sperm and the seminal fluid; in other words, I think the prostate contributes something which influences the metabolism of the sperm and that is why I have tried to get clear prostatic secretion to use in further experiments.

TRAUMATIC RUPTURE OF THE URETHRA

GEORGE GILBERT SMITH, M.D., AND E. ROSS MINTZ, M.D.

From the Urological Department of the Massachusetts General Hospital, Boston, Massachusetts

Traumatic rupture of the urethra is not of frequent occurrence. In the past twenty years, twenty-eight cases were admitted to the Massachusetts General Hospital. These twenty-eight cases, together with two others encountered in private practice by one of us, supply the data upon which this article is based.

The etiology of this condition is well known, and consists of several types of injury. Rupture of the penile portion sustained in coitus is rare; we met with one such case. Rupture of the bulbous portion caused by a blow on the perineum occurred in twelve cases. In most of these accidents the patient fell astride of some hard or pointed object, such as a fence, a beam, a chair-back or the edge of a barrel. Complete rupture of the urethra between the two layers of the triangular ligament was brought about in one case by penetration of the perineum by the leg of a stepladder upon which the patient impaled himself. A remarkable case was that of a boy of eleven who, finding an unexploded shell in a field adjacent to Camp Devens, pounded it until it exploded. The boy's right hand was blown off, and a fragment of the shell entered the perineum, after first carrying away the right testicle. The piece of metal, perforating the anterior wall of the rectum and the prostatic urethra, lodged in the perineum.

Five cases of rupture were due to falls from staging, cars and wagons. In four of these there was an associated fracture of the pelvis. Ten cases were due to crushing injuries, the patient having been caught between cars, between a steamer and the wharf, or between the jaws of an excavating bucket. In nine of these cases the pelvis was fractured. In many of them the exact extent of the injury was not clear, nor was it possible to say whether the urethral injury was caused by a spicule of bone or by the bladder being torn from the urethra by direct force. Garlock[7] reports a case of rup-

ture of the urethra due to sudden muscular effort, without any external trauma at all.

The urethral injury may consist of a simple abrasion or interstitial rupture of the urethra without loss of continuity, of a partial rupture or of a complete separation of the ends of the divided urethra. The case of injury to the penile urethra showed a complete division of the canal, the ends being 1.5 inches apart; there was a wedge-shaped tear extending into both corpora cavernosa. In ruptures of the bulbous portion due to direct trauma, as much as 2 inches of the urethra may be actually destroyed. In such cases there is great laceration of the peri-urethral tissues, accompanied by extensive infiltration with blood; the devitalized tissues are easily infected and may become gangrenous.

Injuries to the urethra proximal to the triangular ligament consist of lacerations caused by spicules of bone, or of complete rupture at the apex of the prostate. In the former, blood and urine may fill the space of Retzius, and an instrument passed into the urethra may leave the canal and enter the perivesical space. In the latter, the bladder and prostate may be carried upwards by the blood which pours out from the plexus of veins surrounding the prostate, so that all connection with the lower urethra is lost. Young,[10] in a paper read before this Association in 1928, described a number of cases of this type.

The symptoms of ruptured urethra are bleeding from the meatus, which may be least in amount when the rupture is complete, difficulty in voiding, and the evidences of periurethral trauma, such as hematoma of the perineum, scrotum and lower abdominal wall.

Interference with urination may vary from slight discomfort and difficulty in voiding to complete retention. It is surprising to find that even in some cases of complete rupture, the patient is at first able to void; within a short time urination becomes increasingly difficult and perhaps impossible. In one of our cases in which a fall astride the back of a chair caused complete separation of the torn ends of the bulbous urethra, the patient was able to void for six weeks after his injury.

In all ruptures except those of slight extent, the passage of a catheter as far as the bladder is usually impossible. If the rupture is above the triangular ligament, the catheter may pass into the perivesical space, and the drawing of pure blood may lead the

surgeon to believe that the bladder is ruptured. In those cases which are complicated by pelvic fractures, there is almost always profound shock.

As to the treatment, these cases may be divided into two classes. Those with perineal injuries and without other severe complication, such as fractured pelves or femurs, may be treated with the object of immediately restoring the integrity of the urethra. Marion,[8] who is very conservative in his management of these cases, advises against any interference, even the passage of a catheter, if the patient is able to void. If he cannot void, the passage of a soft rubber catheter should be attempted; if that is successful, a catheter should be left in the urethra until the rupture is healed. Extensive hematomata should be incised and drained. If a catheter cannot be passed, Marion advises suprapubic cystotomy; the repair of the urethra may be done at the same time or may be left until later.

This conservative position does not seem to be held by most American surgeons. Young advocates immediate repair when that is possible. Berry[3] of Montreal, who reports thirty-six cases of rupture of bladder and urethra, does likewise. Berry,[3] G. G. Davis,[5] Banks[2] and Flandrin[6] advocate, as does Marion,[8] suprapubic cystotomy and retrograde catheterization. We believe that this is not necessary in the majority of cases of simple rupture. In our series, there were thirteen cases of rupture in the bulb which were successfully treated without cystotomy. Among these thirteen, there were seven patients with complete rupture, in whom end-to-end suture was done. Four, who had only partial ruptures, had perineal section and a catheter passed either through the perineum or through the entire urethra. One was treated by indwelling catheter alone, and one, in whom a catheter could not be passed, recovered without any operation. Another patient who was treated by indwelling catheter without operation developed extensive gangrene of the perineum. Perineal incision was done three weeks after entrance, but the patient died two days later. This was the only death among the cases of rupture unaccompanied by fracture of the pelvis. The time spent in the hospital by those who recovered ranged from eleven to fifty-eight days, with an average stay of twenty-five days.

These cases were handled by different operators, but in no instance was there apparently any great difficulty in finding the

proximal end of the urethra. A suggestion made by Garlock[7] may prove worth remembering. He says that pressure on the bladder causes urine to trickle from the severed urethra, thereby locating the proximal end. Another point worth bearing in mind is made by Flandrin,[6] who in three cases of rupture of the bulbous urethra found a loss of substance of the urethral wall. He followed the Guyon-Noguès technic, which consists in suturing the naked tissues of the bulb over a catheter passed through the urethra. The canal so formed becomes lined with epithelium and functions satisfactorily. The catheter should be retained for from thirty-five to forty days, as Noguès, by experimenting with dogs, found that such a canal became lined with epithelium in about six weeks.

When rupture of the urethra is complicated by pelvic or femoral fractures, the prognosis is very different. Shock in itself may cause death within a few hours, especially when it is augmented by extensive perivesical hemorrhage. The clinical picture is unmistakable; the patient is cold and pallid, the scrotum, groins and lower abdominal wall are discolored by subcutaneous hemorrhage. There may be a trickle of blood from the urethra. Palpation of the lower abdomen tells but little, as the muscles are in spasm. Upon passing a catheter, the instrument may be obstructed in the region of the triangular ligament or may pass this point and draw only blood. The latter phenomenon may be due to rupture of the bladder, or may result from the drainage of an extravesical hematoma, the catheter having left the urethra. What, then, is the proper surgical procedure? The one which is generally accepted is immediate suprapubic cystotomy; this seems to us to be the only safe method of treatment, in spite of its high mortality. The bladder should be explored for rupture, and extravesical hemorrhage should be controlled by packing. Whether any attempt should be made to repair the urethral injury depends upon the condition of the patient. If there is evidence of much injury to the perineal tissues, simple incision for drainage of the hematoma is indicated. If this is not done, necrosis of these tissues may occur. The retrograde passage of a catheter appears to be a worth while measure; if it is possible, it takes but very little time, and may make later repair operations unnecessary. If there is no evidence of rupture of the bladder, and the patient is not in too much shock, a perineal operation along the lines described by Hugh Young[10] may be the wisest

course to follow. Approaching the prostate and membranous urethra as if about to do a perineal prostatectomy, one can repair posterior urethral injuries and restore the integrity of the canal.

The gravity of urethral rupture when associated with pelvic fracture is shown by the results obtained in the thirteen cases in our series. Of the four patients whose injuries resulted from falls, all of whom had cystotomies, three died within twenty-four hours. One, a boy of nine, lived. Of the nine patients whose injuries were of the crushing type, five died. In this group, three of the deaths occurred much later than in the first group, and were due apparently to sepsis in or about the urinary tract. One patient, who was not operated upon, died a few hours after admission; another, who died three days after being struck by a taxicab, had fractures of the pelvis, the left femur, and possibly of the skull. Of the four patients who lived, one had no operation, but was drained by catheter for sixteen days; one had a cystotomy and retrograde catheterization and was discharged in thirty-one days; one had cystotomy and left the hospital after fifty days wearing a suprapubic tube; and one had cystotomy, perineal section and retrograde catheterization. He was discharged eight weeks after operation.

Several observers (Abbott,[1] Young[10]) report cases of urethral rupture associated with pelvic fracture in whom impotence resulted. This condition is believed by Abbott to be due to rupture of the greater and lesser cavernous nerves. This result has not been noted in any of our cases, but the point has not been made the subject of particular inquiry.

Brief abstracts of some of the more interesting cases in this series are as follows:

CASES OF RUPTURE OF THE PENILE URETHRA

Case 1.—G. T., an Italian of thirty-two, stated that one week before entrance, while attempting intercourse, his penis bent double and caused instant severe pain, followed by swelling. He called a doctor who tried unsuccessfully to pass a catheter, and then put him to bed with hot lysol dressings. The patient was able to void until the evening before admission to the hospital.

The penis was crooked, swollen and almost beyond recognition, with dark brown, thin fluid leaking from the meatus. The scrotum was somewhat swollen and showed a bluish discoloration.

Operation was performed (G. G. S.). A filiform could not be passed through the urethra. A median perineal incision was made.

A dilated urethra was opened with escape of urine; instruments passed easily to the bladder. When passed forward they entered a cavity beneath the skin of the penis. A tube was passed to the bladder. A longitudinal incision was made through the skin of the penis, thereby opening a cavity between the body and the skin of the penis from scrotum to corona. The urethra was found completely divided with ends about 1.5 inches apart. There was a wedge-shaped tear in both corpora cavernosa. The ends of the urethra were freed and drawn together about a catheter and sutured with chromic catgut. The cavity was packed wide open with gauze. A urethral fistula developed. A second operation was performed (G. G. S.) thirteen days after the first operation. An elliptical incision was made about the fistula on the left side of the penile urethra. The two layers were separated and approximated by a figure of eight silkworm gut suture. The patient was discharged forty-one days after entrance.

Case 2.—W. S., aged forty-five, male, was hanging paper from a low stepladder when suddenly the ladder overturned. The patient landed with his perineum against one leg of the now bottom-side-up step-ladder. He got up readily and walked to the elevator. Because he was bleeding profusely from the wound in his perineum made by the ladder leg, he entered the hospital. In the emergency ward he was unable to pass urine, and catheterization was impossible. A cystotomy was done at once (J. L. W). Physical examination showed a large triangular area of ecchymosis covering the perineum from the base of the scrotum to the rectum, and some swelling of tissues under this area. Just at the right of the anus was a punch or stab wound which was bleeding profusely. Seventeen days later a second operation was done (G. G. S.). A sound was passed but did not go beyond the triangular ligament. Through a curved pre-anal incision the posterior aspect of the prostate was exposed. It was found that the blow had separated the two layers of the triangular ligament and severed the urethra in this region. A bougie was passed from the bladder downwards, emerging in the center of the posterior leaf of the triangular ligament. A catheter was passed through the urethra. The urethra was not sutured. The two leaves of the triangular ligament were well approximated with catgut sutures, bringing the severed ends of the urethra into close apposition about the catheter. The suprapubic wound healed a month after cystotomy and the urethral catheter was removed thirteen days following perineal section. The patient voided well. He has been followed in the Out-patient Department and sounds have been passed without difficulty.

Case 3.—J. A. B., a physician of sixty-one, fell astride the back of a chair, striking his perineum. He bled freely from the urethra at first, and continued to pass some blood for ten days. Voiding was very painful and rather difficult. For about a month he was able to

void satisfactorily, but in the next two weeks the stream became progressively slower until it stopped almost entirely. Examination showed a hard mass 1.5 cm. in diameter in the perineum. A filiform could not be passed beyond this point. At operation (G. G. S.), the urethra was found to be completely severed, with a pocket containing infected urine about the two ends. These were torn irregularly, but by freeing them they could be dovetailed together and sutured. A catheter was left in the urethra for twelve days. There was never any urinary leakage and the patient was discharged sixteen days after operation. Five months later the urethra admitted a No. 28 French sound without any difficulty.

Case 4.—A. M., aged eleven, on May 11, 1928, hammered an unexploded shell which he found in a field near Camp Devens. The shell exploded, blowing off the boy's right hand and right testicle. On May 12, 1928, a suprapubic cystotomy was done. A week later a fragment of shell and a piece of the pubic bone were removed from the perineum. Two weeks later the suprapubic tube fell out, after which the urine, as well as gas and feces, drained from the perineum. On June 19, 1928, the patient was admitted to the Massachusetts General Hospital and on June 29 he was again operated upon (G. G. S.). Through a curved pre-anal incision, the posterior aspect of the prostate was exposed. The rectum was found to be adherent to the prostatic urethra, with a fistula between the two. The rectum was freed from the prostate and the rectal fistula was closed. A catheter was passed through the urethra. Part of the right lateral wall of the bulbous urethra was lacking. A month later the patient was discharged. The perineal and rectal wounds had closed, but when the boy voided, a part of the urine escaped through the wound in the right groin. Two months later this leak had almost ceased, and could be controlled by pressure.

CONCLUSIONS

1. Thirty cases of traumatic rupture of the urethra are reported, of which thirteen were complicated by fractures of the pelvis.

2. Of the seventeen cases not complicated by fractures, two patients had no operation, two had preliminary cystotomy with later repair of the urethra, seven had perineal section with suture of the divided urethra, and six had perineal section without suture of the urethra. There was one death (6 per cent).

3. Of the thirteen cases complicated by fractures, two patients had no operation (one death); two had suprapubic exploration but not a cystotomy (two deaths); nine had suprapubic cystotomy (five

deaths). The total number of deaths was eight, a mortality of 61.5 per cent.

Uncomplicated rupture of the urethra, of the type that commonly results from a blow on the perineum, may be satisfactorily repaired by perineal section alone. Ruptures accompanied by fractures of the pelvis as a rule require suprapubic cystotomy.

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THE TREATMENT OF MALIGNANT GROWTHS OF THE MALE URETHRA

A CLINICAL REPORT

WILLIAM E. LOWER, M.D.
Cleveland Clinic, Cleveland, Ohio

That primary carcinoma of the male urethra is a comparatively rare condition is evidenced by the small number of cases reported in the literature. In 1922 Braasch and Scholl[2] published a complete review of the literature up to that date, and reported a case. Since that time additional cases have been reported by Kretschmer[8] in 1923, Culver and Forster[4] in the same year, Christen[3] in 1925, Neuwirt, Bedrna[9] and Peters[10] in 1928. In 1928, additional cases were also reported by Fukai,[6] and in 1929 by Flamm,[5] Bieberbach and Peters,[1] and also Huggins and Curtis,[7] bringing the total number reported in the literature up to 110 cases.

To this number I wish to add three cases which have come under my observation and in which operation has been performed. All three patients are living at the present time without any signs of recurrence, one for nine years, one for eight years, and one for three and one-half years after operation. In one case there was a history of injury to the perineum; in another a history of long standing inflammation of the urethra followed by stricture, and in the third there was also a history of chronic urethral inflammation. In two of the three cases a local resection of the urethra was performed with end-to-end anastomosis. In both of these cases stricture followed; in one case an internal urethrotomy was necessary and the patient still has a rather firm, tight stricture, although he is not greatly inconvenienced. In the other case the urethra is about normal in size with a tendency to narrowing after intervals of six months, if it is not dilated. In neither case, however, is there any evidence of metastasis. In the third case extensive metastases were present in the inguinal glands, and there was extensive urethral involvement. This patient had a double inguinal hernia, and was also a diabetic. A block dissection was done in this third case, in

which the penis and urethra anterior to the growth were removed, together with the testes and inguinal glands; the proximal urethra was transplanted into the perineum, and the herniæ were closed. The patient made a good recovery and is free from any evidence of recurrence at the end of three and one-half years.

The pathological diagnoses in these cases were squamous cell carcinoma in the first case, papillary carcinoma in the second case, and adenocarcinoma in the third case. In this last case the growth probably started in some of the glands adjacent to the urethra, but for clinical purposes it may be classified as of the urethra.

It is difficult to make an early diagnosis in these cases. The symptoms are largely those of stricture with attendant abscess formation, and the real cause of the trouble may be overlooked until extension has taken place. If the condition can be recognized early, operation offers very good chance of permanent relief. Our experience has confirmed other reports that carcinomata of the male urethra do not metastasize early. Fistulæ are nearly always present. These tumors occur mainly in the membranous portion of the urethra.

From the history of the cases coming under our observation, traumatism and chronic irritation were the predisposing causes.

The success of the surgical treatment depends upon the stage of the disease at which it is instituted. If the cases can be treated early, while the condition is still localized, the results will be good, as attested by our experience in the three cases described here. In one case there was extensive involvement of the inguinal glands, but we hope the process was checked at this point. Although three and one-half years have elapsed, it is still too early to consider the cure complete. X-ray and radium following excision is to be recommended and may be of benefit. If the case is inoperable, certainly radiation should be employed.

CASE REPORTS

Case 1.—The patient was a laborer, fifty-eight years of age. There was nothing in the general history having any bearing on the condition which was present. He gave a history of some sort of injury to the perineum some years previously, which was followed by a rectal fistula. Two years before being admitted to the clinic he had had an acute retention which was caused, he said, by a cyst of the urethra. No definite history of this condition could be obtained except that a

perineal incision had been made for the relief of retention; this was followed by a fistula.

At the time I saw the patient an acute retention was again present, together with extensive perineal induration, infection, chills and fever. A suprapubic puncture was made for relief of the retention. After the acute symptoms had subsided, and much of the perineal edema had been reduced, an operation was undertaken for the relief of the stricture. At this time I was not sure that this condition was malignant, although it was unusually hard. The operation consisted in opening the bladder and passing a sound retrograde. At the tip of the sound in the perineum, the urethra was divided, the mass was dissected free and the distal end of the urethra was severed beyond the involved tissue. About 1.5 inches of urethra was resected. By passing a No. 18 catheter from the meatus, an end-to-end anastomosis was made. Convalescence was rather slow, but after a reasonable time the catheter was removed. A small perineal fistula remained, which, however, soon closed. Regular dilatation has been continued, this being necessary now only about twice a year. The patient is in good physical condition, and there is no evidence of recurrence after nine years.

The histological diagnosis in this case was squamous cell carcinoma.

Case 2.—This man, forty years of age, gave a history of a gonococcus infection at the age of twenty-two. Eleven years before being admitted to the clinic he had had an acute retention which was relieved by perineal incision. This was followed by a stricture requiring frequent dilatation.

When I saw the patient in 1923 an acute retention was present and I was unable to pass any kind of instrument past the stricture. I relieved the retention by a suprapubic puncture. A very hard, indurated area was found in the perineum. Remembering my experience of a year previous with a similar condition, I made a diagnosis of probable malignancy. A resection was done as in the previous case, and a course of X-ray therapy was given following operation. Union at the point of anastomosis of the ends of the urethra was not very satisfactory and a very tight stricture resulted. An internal urethrotomy was performed two years later, and since then dilatation has been done at regular intervals. There is no evidence of recurrence after eight years.

The histological diagnosis in this case was papillary carcinoma.

Case 3.—This man, sixty-one years of age, gave a history of a gonococcus infection at the age of twenty-five. He was admitted to the clinic on account of difficulty in urination. Extensive induration was present in the perineum extending along the entire urethra. The inguinal glands on both sides were involved; a biopsy of a gland showed malignancy. Nothing short of an extensive block dissection seemed worth while. The hazard of such a procedure was explained to

the patient and his family; he requested that the operation be performed.

The penis and the testes and inguinal glands on both sides were removed and the urethra was transplanted into the perineum. Bilateral herniæ were present which were easily corrected after the testes and inguinal glands had been removed. The patient was also diabetic, but is no longer handicapped by this condition. After three and one-half years he seems to be perfectly well and there is no evidence of recurrence.

SUMMARY

1. Practically all published reports of cases of malignancy of the male urethra stress the difficulty of an early diagnosis.

2. The condition is often associated with, and resembles the induration of an infection about a stricture.

3. The condition does not produce early metastasis.

4. Operation, even without resection of the inguinal glands, may produce good results.

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SURGERY OF HYPOSPADIAS AND EPISPADIAS IN THE MALE

ARTHUR B. CECIL, M.D.

From the Hospital of the Good Samaritan, Good Hope Hospital Foundation and the Children's Hospital, Los Angeles, California

This work has been undertaken for the purpose of standardizing the surgical treatment of congenital defects of the urethra. I have carefully reviewed the literature from the efforts of Dieffenbach, in 1836, until the present time. From this review and from my own experience, and from the critical discussion following the presentation of this paper, I hope that we today may be able to clarify many of the problems involved and formulate some valuable suggestions as to the proper mode of treatment of these deformities. The number of operations which have been devised for the correction of congenital defects of the urethra is astonishing and it is evident that no surgeon could have had personal experience with all of them. The whole question is in a state of surgical bewilderment which needs logical consideration. Where I have found problems yet to be decided, I shall definitely state them, but where I have found little or nothing to recommend any given technic, I think that also should be stated and the procedure abandoned.

In doing plastic surgery for the cure of deformities of the urethra there are certain general considerations which are necessary for success. These are quite apart from the ingenious methods which have been devised for the treatment of hypospadias and epispadias, but have in the past been tremendously neglected and yet they are extremely important and essential. Undoubtedly very many splendid operations have been ruined by the neglect of some small detail which was necessary for success, and it is only by meticulous attention to detail that one can hope for any possibility of uniform success.

Davis has recommended that the operative field be scrubbed with soap and water with gauze and that this preparation be followed by ether. He thinks that iodine is likely to irritate the skin. It

has been my experience that 3.5 per cent iodine immediately washed off with alcohol is most satisfactory. One should bear in mind that the hypospadiac urethra is likely to be a source of infection unless it is also sterilized. For this purpose Bidgood has recommended the injection of 2 per cent mercurochrome.

In regard to sutures, the earliest material used, that is to say, following the days of pins, was silver wire. Duplay thought that this was the best. More recently Hagner has laid great weight upon the use of silver wire. I have found that for buried sutures in making urethral flaps No. 000 plain catgut is very efficient material. For the suturing of the skin I have used black silk. Where one needs quite strong tension sutures, such as in bringing the corpora cavernosa together in epispadias, I have used No. 0 chromic gut. In all instances I have used interrupted sutures in spite of the fact that this has the disadvantage of numerous small knots where sutures are buried. Beck has suggested that in making the urethra from plastic flaps the sutures be tied within the urethra as one goes along.

One of the greatest causes of failure in doing plastic work on the urethra is inattention to the absolute stasis of blood. No skin flaps can possibly heal if there is an intervening blood clot. One does not like to put any more knots under the skin than necessary, but if there is the slightest tendency toward bleeding, the points must be ligated. For this purpose I have used No. 000 plain catgut. Bleeding points are not, of course, confined to open operations. Nové-Josserand found in tunnelling that in a number of instances sinuses occurred because of blood clots which had formed along the tunnel and later broke down and ruptured through the skin.

The methods for diverting the urine from the field of operation differ with different conditions. In reconstructing the urethra in perineal hypospadias one cannot improve upon the hypospadiac opening for voiding urine until all other plastic work is finished. The urethra should be reconstructed down to within 1 cm. of the opening and then a suprapubic drainage done for the closure of the perineal and newly reconstructed urethral openings. This drainage should be done about ten days previous to doing the plastic work on the perineum. There is no advantage in doing it at the same time, and there is some advantage in knowing that

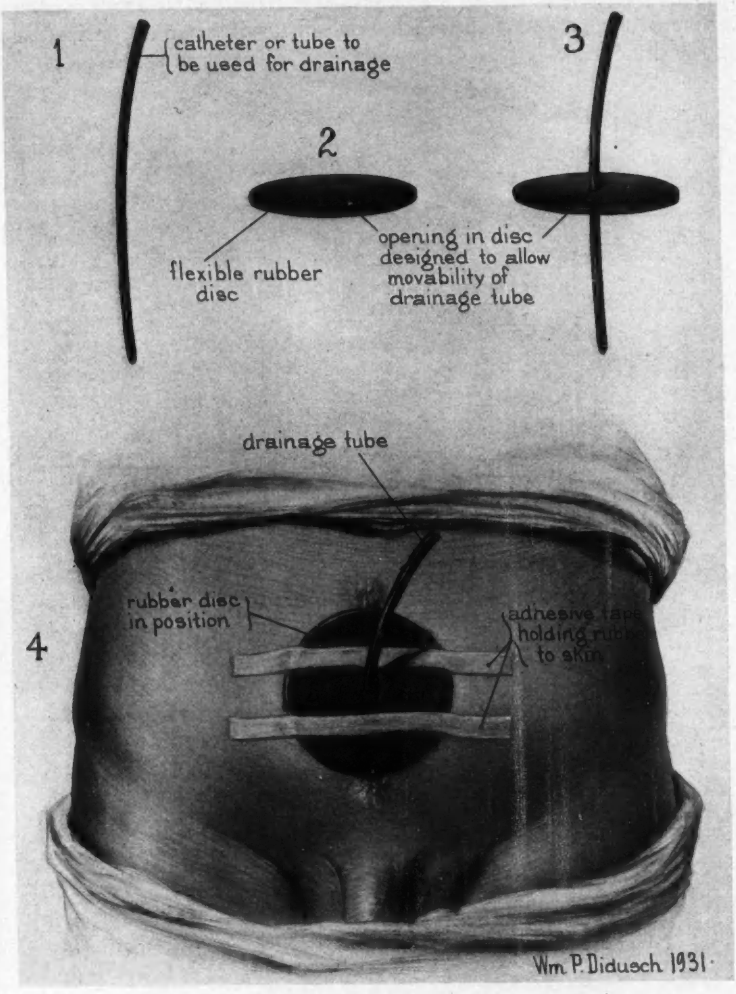

Fig. 1. Author's suprapubic drainage apparatus.

it is well established. For the suprapubic drainage where it is necessary over a period of time I have used a tube which I devised as shown in Figure 1, which consists of a catheter passed through a

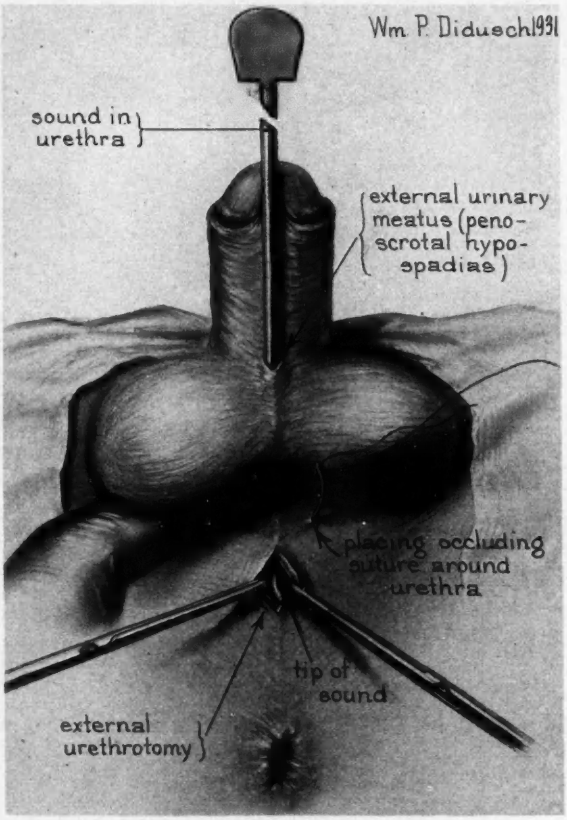

Fig. 2. Perineal drainage and ligation of the urethra after Young.

rubber disk, the rubber disk being strapped to the abdomen. This drainage tube is, by the way, the best tube that I have ever encountered where it is necessary to do prolonged drainage as in carcinoma

of the prostate, and so forth. Pezzer catheters are difficult to get out, difficult to clean, and liable to break off. It is my impression in operating on children that they seem to form lime salts that plug drainage tubes more frequently than adults. Where one is operating for penile or peno-scrotal hypospadias a perineal opening of course can be quickly made by cutting to the tip of a slightly curved sound. While the sound is in position, a suture is thrown around it as recommended by Doctor Young in order that no urine can possibly pass into the urethra and into the newly operative field (Fig. 2). I do not believe that it is possible to maintain a dry field without this suture about the urethra. This simple device is possibly one of the greatest contributions which has been made in recent years in the treatment of these conditions. The sutures should be tight enough to occlude the urethra but not tight enough to cut the urethra through, in which event it would defeat its purpose. As a rule it will cut through the tissues somewhat but this seems to do no particular harm and does not cause stricture.

Thiersch, who first introduced perineal drainage for the purpose of diverting the urine in the treatment of defects of the urethra, did so not only to divert the urinary stream away from the field of operation, which he found that it would not completely do, but he thought it was a good thing to do anyway as it kept the patient's bed drier. Now, in operating for penile and peno-scrotal hypospadias, it is only necessary to do a perineal drainage. This is quite different from the matter of bringing about an anastomosis in the case of perineal hypospadias, where, I believe, it is well to divert the urine by means of a suprapubic drainage at the time the anastomosis is attempted.

Among some of the earlier operations done for the cure of epispadias, perineal drainage was carried out previous to attempting to do anything in order that the skin might be cured of the excoriations due to urine. More recently, Doctor Young has found that suprapubic drainage done at the time of repair of the internal sphincter will accomplish much the same thing and allow the excoriated portion of the penis to become normal for the subsequent plastic operation for reconstruction of the urethra and repair of the external sphincter.

It has been recommended that drainage be done at the time of the operation for the correction of the deformity in hypospadias.

It is possible that one might get a somewhat cleaner skin healing, but when it is considered that this operation for the correction of the deformity of the penis should be done very early in life and that the subsequent operation of reconstructing the urethra is to be done several years later, it does not seem advisable to do any type of drainage to divert the urine at the time of the correction of the deformity, as again such drainage procedures would almost surely infect the child's bladder and very little is to be gained as a matter of diverting the urine now. The skin will always heal and so much time must elapse between this correction of the deformity and the plastic work done for the reconstruction of the urethra that scarcely any scar will be found at the time of doing the later operation. So important is drainage, however, that when the plastic reconstruction of the urethra is done I have found it justifiable to establish, a week or ten days before, a suprapubic drainage in addition to a perineal drainage where I have been operating for penile or peno-scrotal hypospadias. The two drainage tubes are much more likely to prevent trouble and to assure a smooth convalescence, and so many things can go wrong with drainage tubes.

Dressings used after plastic operation should be of plain gauze, fitting the penis fairly snuggly in order that the tissues might be held quite firmly together, but again the avoidance of too great pressure is a matter that must be most carefully observed. In operating on the urethra where it is carried down to the perineum and the patient is using the perineal hypospadiac outlet for the voiding of urine, I believe that it is useful to cover the lower portion of the wound with collodium. Rubber dam has been used by others for this purpose. Careful nursing is here most essential in order that the dressing may not become sopped and left wet in contact with the wound.

I now come to what I believe to be the most essential consideration in the cure of hypospadias; namely, constant and continuous nursing with personal supervision. Nurses are very likely to consider these patients as ill people and to nurse the boy rather than the region of the wound. So many things can go wrong with these operations that I am convinced that under no pretense whatsoever should they be left in the first ten days after the plastic work. Much more depends upon the above general principles in

the curing of these children than by any type of technic which has been invented for the reconstruction of the urethra. I believe that a close observation of these principles should make most of the operations which have been devised successful. I am sure that a neglect of them would only in the rarest instance permit any of these operations to be successful. In addition to the above I would refer to the work of Churchman, who has laid down some very interesting principles of plastic surgery as applied to the treatment of congenital defects of the urethra.

HYPOSPADIAS

I shall first consider the subject of hypospadias. Many operations have been devised for the treatment of minor degrees of hypospadias, and, in fact, some of the earliest operations done were instituted for this purpose. The only reason for operating on any hypospadiac patient is to correct deformities which interfere with the function of urination or procreation. To these some surgeons have added the additional consideration of operating on minor degrees of hypospadias because of mental disturbances which have arisen in regard to this defect. I think that we can very definitely reach the conclusion that no operation should be carried out in childhood for the correction of minor degrees of hypospadias, for not only am I convinced that such operations are not justifiable, but to do so would require diversion of the urinary stream, which is likely to be associated with a cystitis and a pyelonephritis. Now it is true that we subject children to these hazards in the treatment of more marked deformities, but there it is justifiable. The best that can be said for any attempt to treat minor degrees of hypospadias is that it is an operation for an adult to decide upon and for the surgeons to refuse to do. There is always a possibility of failure, in which event the hypospadiac opening is likely to be farther back than it formerly was. The surgeon becomes involved in a series of operations, the net result of which is likely to leave the patient in a worse condition than he formerly was.

Something like sixty years ago, J. L. Pettit, in dissecting the genital organs of a child, ten years old, whom he had examined during life and who had peno-scrotal hypospadias with deformity, inflated the corpora cavernosa and then separated the urethra from the corpora cavernosa. He found that the penis still kept its de-

formity and he attributed this to a fibrous band beneath the penis but even the division of this band did not straighten the penis. In making a study of the cells of the corpora cavernosa Pettit found that there was an atrophy of these cells on the concave portion. He did not know whether they had always been in this condition or whether this atrophy was secondary to the hindering bands beneath the penis. Buisson also insisted upon the participation of the corpora cavernosa in the malformation and noted the arrest of development of the corpora cavernosa on the under surface where the urethra is lacking. Duplay showed that the intracavernous septum played a part in the deformity. Clinical experience would seem, however, to bear out the statement that if the skin, subcutaneous tissues, and fibrous bands extending up between the corpora cavernosa are divided sufficiently early in life that the corpora cavernosa will fully develop. It should be noted, however, that the autopsy report of Pettit was made on a child of only ten years of age, and this brings about the very practical point that the operation for the correction of the deformity in hypospadias should be carried out very early in life in order that the corpora cavernosa may fully develop. I can recall but one or two authors who have suggested that this operation be done within the first two years of life and yet I am convinced that it is at this time that the operation should be done. The operation for the correction of the deformity should be done as soon as the child has been weaned and its nutrition has been fully established.

Obstetricians and pediatricians should be thoroughly familiar with this subject. Credit is usually given to Bouisson for originating the operation for correcting the deformity of the penis in hypospadias. Bouisson's work was published in 1861. It is of interest to American surgeons to know that Dr. J. B. Mettauer of Prince Edward County, Virginia, writing, in 1842, on hypospadias, first described a method for the subcutaneous division of the fibrous bands thus antedating Bouisson's work by eighteen years. It was Duplay who first used the procedure of the open transverse incision and closing the wound longitudinally, and this is the most satisfactory method and the method which is almost universally used today.

The transverse incision should divide Buck's fascia and all constricting fibrous bands of the intracavernous septum. Some authors have suggested that in some instances it is wise to cut into the

corpora cavernosa. It seems to me that this is a bad procedure on account of hemorrhage and probably would be altogether uncalled for if the operation of correcting the deformity is done sufficiently early in life. The essential thing is that an absolute correction of the deformity must be made. In doing the operation for the correction of the deformity the urethra, of course, will be shoved very much farther backward. Beck has suggested that at the time of making the transverse incision the lozenge-shaped defect should be covered by the foreskin, which is buttonholed, and the penis passed through the foreskin, thus giving a skin graft covering to the under surface of the penis and at the same time placing the redundant foreskin there for future work in reconstruction. I am inclined to believe that the operation for hypospadias should be as simple as possible, and I do not believe in the transplantation of the foreskin very early in life for the covering of the open space created by the transverse incision. There is a danger of loss of very valuable tissues which subsequently will be needed.

Pousson has called attention to the fact that the glans deformity in connection with the shaft of the penis is in addition to the elbowing or curvature of the penis on the scrotum, and points out that severing of the tissues beneath the penis cannot correct the malposition of the glans. He recommended, as an operation for the correction of the glandular deformity, that the glans be separated from the two cavernous cylinders by incision, that a triangular piece be cut out on the dorsum penis, and that the tissues then be sutured. He recommended that this operation be done after the one for the correction of the downward curvature. Pousson states that as a result of this procedure the glans at first is flabby, withered and without sensation but soon becomes normal. At best this operation creates a bad condition on the dorsum of the penis to counteract a similar one on the ventral surface, and I do not believe that there is any justification for this operation whatsoever.

RECONSTRUCTION OF THE URETHRA

I shall now take up the question of the actual reconstruction of the urethra. One finds in the literature mention of the use of heteroplastic grafts for this purpose. I have had no experience with heteroplastic grafts, nor have I found any record of any

specific instance in which the urethra has been reconstructed by this method. In view of the questionable nature of homoplastic grafts, I would think that one would be reaching far out into a very experimental field to attempt to reconstruct the urethra by any type of animal graft. In view of the ease with which other material may be obtained there would seem to be no justification for attempting to do heteroplastic grafting.

There is considerable difference in opinion as to the advisability of utilizing isografts and even as to whether such grafts will persist. It is possible that the success or failure of such grafts is somewhat dependent upon the similarity or dissimilarity of blood groups of the host and donor. Masson at the Mayo Clinic reported excellent results with isografts in skin grafting, but never had a successful result in which the red blood corpuscles were agglutinated by the serum of the patient. Shawan has confirmed these findings. Irrespective of the use of skin of one individual which may be transplanted to another, the attempts at isografting for the reconstruction of the urethra are open to considerable doubt as to their success. Schmieden reports three cases in which he attempted to transplant the ureter, the result of which operations seems to show that it might be possible to transplant a ureter from another individual. The results obtained by Schmieden in attempting to do so were very bad indeed, however. In one case the patient disappeared before the two canals had been united. One case was a complete failure, and in one case the patient was apparently cured but required a great deal of dilatation. One might in this connection mention the work of Legueu to reconstruct by means of vaginal mucosa, not hypospadiacs, but war injuries of the urethra. Apparently the canal was established but the case required prolonged dilatation and it is questionable as to what part the vaginal mucosa played in the actual formation of the canal.

The use of the appendix was first suggested by Lexer in 1911 and since then has been used by Streissler, Weitz, Rosser and McGuire. McGuire apparently got satisfactory results in three patients in whom he reconstrucetd the urethra from the appendix. His article is not quite clear that all of these cases were isografts, but one of them definitely was so and a satisfactory result was obtained. That McGuire believed that isograft material would be satisfactory is shown by the fact that he suggests that in recon-

structing longer portions of the urethra two appendices might be sutured end to end. Blair in discussing McGuire's work stated that he was very much surprised at the results secured as it was his experience that no graft would grow from one individual to another. McGuire thought that the graft might possibly have acted as a scaffolding and might not have grown as a true graft. Axhausen in his article on the prognosis of transplantation of the appendix in hypospadias discusses the subject from an experimental and clinical standpoint. He quotes the work of Weitz, who reported two cases, but Axhausen thought that, inasmuch as these cases were reported one only two months and one only four months after operation it was too early to know what might subsequently happen to these grafts. Apparently when they were reported, the canal was established, but Axhausen states that the appearance of the mucous-membrane-like lining does not necessarily mean that this is the case, and that, unless the mucosa persists, sooner or later granulated tissues will cause obliteration of the canal.

He states that a urethral tube may be very deceiving and that the epithelial lining may persist for a considerable length of time only to be ultimately obliterated. In experimental work on animals he found that appendix mucosa would grow only in one situation, namely, when it was fed by the omentum. Axhausen reports two cases in which he transplanted the appendix mucosa, both in four-year-old boys. Serosa and muscularis were removed according to the method of Lexer. Healing took place smoothly and after three weeks apparently the urethra had been restored. When the time came for anastomosing the new urethra with the old, histological studies showed that there was no trace of epithelium left in spite of the fact that the urethra gave every impression that it had remained alive and was lined with mucous membrane. The walls consisted of smooth musculature which was partly necrotic, and for the rest of connective tissue. The patient remained well for three or four months by the use a bougie, but later the material had to be removed and at this time serial section showed no trace of epithelium whatsoever. As other isograft material one might consider the foreskin of an adult of the same blood grouping as furnishing material for the reconstruction of the urethra in a child. As I shall show later, the difficulties attending free autoplastic grafts are very great and there is no lack of

material in the individual himself, so that while it might be possible to bring about a reconstruction of the urethra occasionally by the use of isografts, it seems to me to be doubtful judgment to attempt to do so.

AUTOPLASTIC FREE GRAFTS

I shall now discuss autoplastic free grafts. Trout of Roanoke, Virginia, has reported the use of the appendix for this purpose with a satisfactory result. Again one must refer to the experimental and clinical observations of Axhausen. Tanton used a vein as had Tuffier, Marion, Leriche, Patel, Unger, Stettineo, Beck, Jaboulay, Carrel, etc. It would seem that such free venous grafts might occasionally take. Still, careful reading of the different reports published shows nearly always the existence of a fistula and in many instance partial or complete elimination of the graft. Tanton and Leriche believe this elimination was due to infection. Cantas regarded the elimination as due to the lowered vitality of the transplanted vein and for this reason suggested the use of the saphenous vein, leaving one end attached and using a piece of skin as an additional supply for nourishment, a pedicle vein skin graft.

One of the greatest exponents of autoplastic free grafts was Nové-Josserand, who, in 1897, promulgated a new method for the treatment of hypospadias. He conceived the idea of making a dermo-epidermal tube from the skin of the outer side of the thigh and to introduce this tube beneath the skin of the penis which had previously been tunnelled, and then by various methods of dilatation he hoped to epithelialize the newly made tunnel. I have reviewed all of Nové-Josserand's work in detail. Fistulæ were common, many times due to an infected clot which formed along the tunnel as I have mentioned above. There was a tremendous tendency toward total obliteration of the canal, and in practically all cases a marked tendency toward shrinkage both in length and in diameter, requiring internal urethrotomy, which in many instances had to be repeated, prolonged dilatations, and new attempts to epithelialize strictured portions. Altogether, I am sure that the procedure is a very unsatisfactory one for the reconstruction of the urethra. Did not one read Nové-Josserand's article for 1914, in which he relates his cases in detail, one might get an entirely erroneous impression from some of the other articles, but this is

reasonable, for nothing but a tremendous believer in his own method could have kept this operator at work tunnelling for twenty-three years in spite of innumerable failures.

I have attempted Nové-Josserand's operation only once. For the time the graft seemed to take, but it ultimately entirely disappeared so that there was no trace left. Infection did not take place nor was the graft extruded. It seemed to be absorbed or gradually eliminated. It was possible that something resembling a urethral canal could have been preserved by prolonged dilatation, internal urethrotomy, and so on, but it did not seem to me that such procedures should form a necessary part to the construction of a urethral canal.

Before taking up a consideration of pedicle grafts for the reconstruction of the urethra, I should like to say something in regard to the work of Beck, whose operation stands quite apart. Beck, like Nové-Josserand, devoted many years of his life to the reconstruction of congenital defects of the urethra. He is best known for his advancement of the urethra operation. Beck's idea was that inasmuch as the urethra was extensible during erection there was no reason why it should not be stretched out at any time, and thus supply the urethral canal. He first began by using this only in very minor cases, but eventually used it in much greater degrees of penile hypospadias. Writers differ as to the value of this operation. It is my own opinion that the best that can be said is that Beck spent a great deal of time in attempting to exact a compromise between the length of the penis and the length of the urethra, with the penis oftentimes winning out. Not only did retraction take place, but it was not uncommon for the urethra, which had been passed through the glans, to slough away, or to break away, from its moorings and fistula to result. In addition to this, it was sometimes associated with rigidity about the urethra which was unbearable.

PEDICLE GRAFTS

I shall now discuss pedicle grafts, and it is in this group that we must unquestionably look for the operations that will successfully cure hypospadias. I think it is well for one to determine at the outset as to whether one considers it advisable to attempt to make a glandular portion of the urethra. It is my own opinion that this

gives some added difficulty to what is already a fairly difficult undertaking, and if the urethral canal is constructed to open in the region of the frenum well forward that this is probably the most normal position that the external urethral orifice could occupy. The glans is always turned downward even though the incurvation has been cured, and it would seem that this type of opening would be likely to be more normal than projecting the urethra upward through the glans.

The decision upon this point would rule in or rule out most of the operations in which a tubular pedicle graft is constructed from the foreskin. Mayo very successfully used the foreskin in the construction of the short portion of the urethra in penile hypospadias, and in combination with Thiersch's operation for the reconstruction of longer portions of the urethra. Russell's operation, which at first sight appears unique, is really nothing more than Duplay's operation as far as the construction of the penile urethra is concerned, to which is added a hood of the foreskin in continuity with the penile flaps, this portion of the graft being used for the development of the glandular portion of the urethra. Donnet's operation is much the same type as Mayo's operation except the tubular foreskin graft is introduced from the side rather than over the dorsum of the penis. I have used the foreskin for the reconstruction of a portion of the penile urethra in perineal hypospadias and there is no question that pedicle grafts derived from the foreskin will almost invariably take and that they will maintain their caliber. They do, however, have a tendency toward contraction in length. This may be relative and due to lack of participation in the growth of the penis. Young constructs the glandular portion of the urethra from the foreskin by a graft taken from a lateral aspect of the penis, thus avoiding anastomosis between the urethra constructed from the foreskin and the old urethra. Bevan's operation consisted in raising a flap from the shaft of the penis in minor degrees of penile hypospadias in somewhat the same way that Rochet's operation is done in turning up a tubular graft from the scrotum in more marked degrees of hypospadias. I believe that Bevan's operation has much to recommend it. Rosenstein has constructed a urethra in hypospadias by turning down a flap of bladder mucosa from above. There are various combinations of operations of narrow base pedicle grafts such as the operation of Beck in which the

urethral canal is formed after the first method of Duplay and then the raw surface covered by a narrow pedicle graft twisted on itself turned up from the scrotum. Of a somewhat similar nature is the method of Crabtree in which the roof of the canal is formed from the skin of the penis which is left attached. The floor of the canal is formed by a long pedicle graft from the scrotum and the raw surfaces are covered by lateral flaps from the penis. I have used this operation in one case. The long pedicle flap broke down, leaving a fistula.

Cantas introduced a method of turning up a pedicle graft of the saphenous vein with the overlying skin. There are many objections to this method, among others being that the vein may not have sufficient caliber or it may be divided.

There is no question in my mind but that the most logical and satisfactory method of reconstructing a urethra in hypospadias is founded upon the principle that the flaps should be of broad base, that they should be constructed from the penis itself in order that there might be no retraction in length and that the roof of the canal should be left entirely attached along the surface of the penis, thus assuring the absolute absence of decrease in diameter, and assuring that the canal will develop with the development of the penis. It is important to avoid anastomosis if possible, for at the points of anastomosis fistula and stricture are likely to occur. Anger, in 1874, was the first to apply these principles. He adapted the operation which had been devised by Thiersch for the treatment of epispadias to the treatment of a case of peno-scrotal hypospadias. Anger secured a perfect result and this was the first case in which hypospadias had really been cured by any method. Duplay's method of raising lateral flaps from the surface of the penis embodies some of these principles, but the operation has a tendency to leave a fistula. Duplay recognized this and subsequently changed his technic so that more tissues might be had for the bringing together of broad surfaces at the external point of suture. He did this by making an incomplete inner tube which was not sutured and then bringing together the outer tube and utilizing the tissues which he had formerly used in the making of the inner tube to assure a broad apposition of flat surfaces which were held together by silver wire and leaded quilled sutures.

Thiersch's operation has a distinct advantage over Duplay's in

that the approximation of the skin edges are not in juxtaposition. It has other advantages than this, in that the broad surfaces bear on one another, and that there is a counterbalance so that one flap in contracting tends to pull the other flap in position and vice versa.

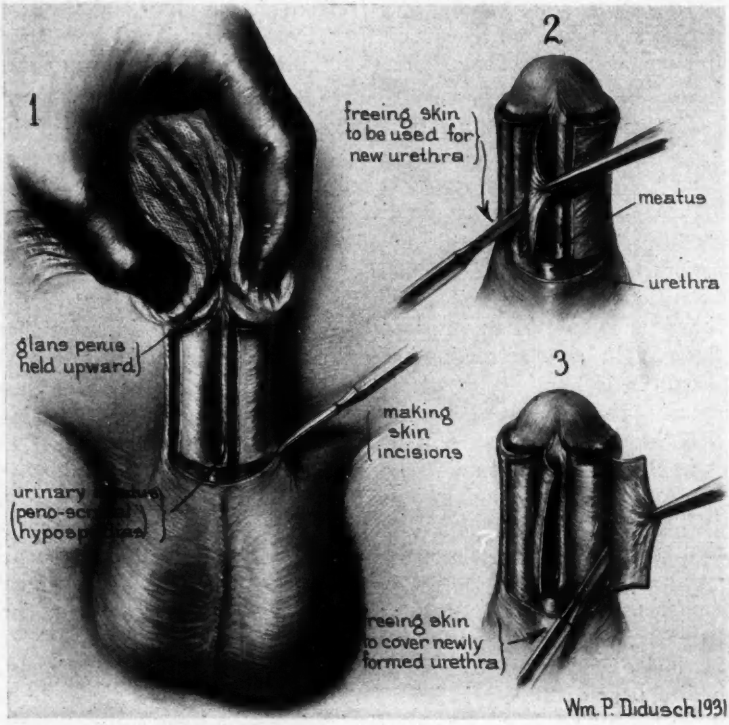

Fig. 3. Adaptation of Thiersch's method for reconstructing the urethra in penile hypospadias. Posterior skin flap has been dissected back.

As one reads the literature one finds that Thiersch's operation has been less frequently used than most other operations, probably because of its apparent complication of construction. But where one finds that this operation has been used one almost always finds that the case has been cured. A very beautiful example of the cure

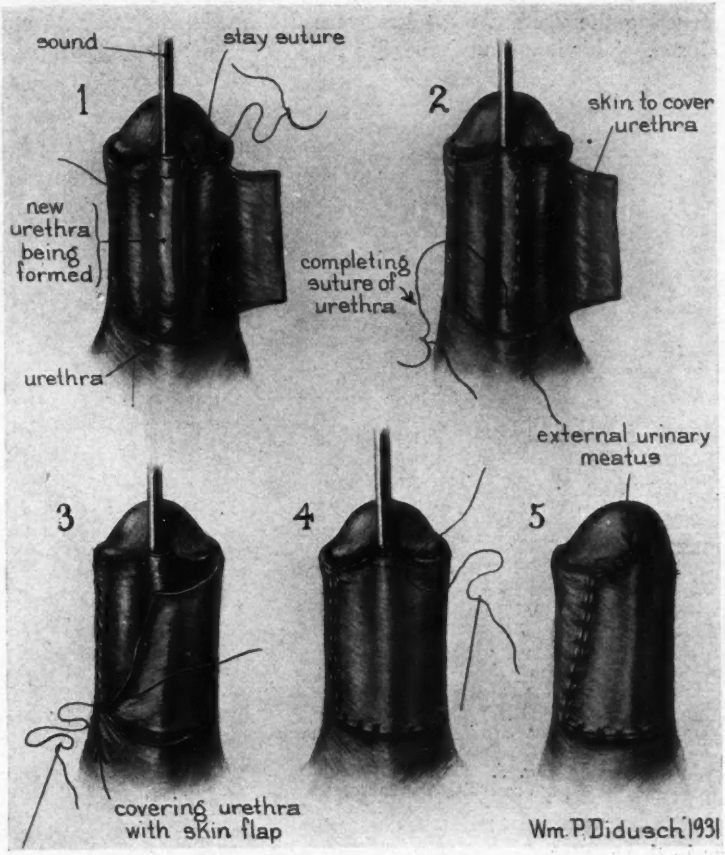

Fig. 4. Note that the anastomosing of the new and old urethra carries out the same principle as the lateral anastomosis. By dissecting back the skin over the urethra posteriorly, the urethral and overlying skin sutures are not in juxtaposition. This procedure avoids sinuses and saves one step in the operation as originally done by Thiersch.

of a marked degree of perineal hypospadias by this method was shown before this society by Hagner in 1922.

In the earlier use of the Duplay and Thiersch methods of reconstructing the urethra the tubes were first made and later anastomosed. This is not advisable in penile or peno-scrotal hypospadias

Fig. 5. Result of Thiersch operation for peno-scrotal hypospadias.

as in these cases the entire operation can be done in one procedure, not only to make the urethra but to make the anastomosis. The flaps should be freely dissected up to about one-half the way around the penis in order that some of the redundant skin on the dorsum of the penis might be brought into use to avoid tension. I believe it is not advisable to use stay sutures from the inner constructed tube that will pass through the outer skin, as this tends to make

sinus formation where these sutures pass through. Without these sutures, however, the penis will assume a twisted appearance at the completion of the flap operation. This should give no concern as experience has shown that the penis will assume a normal shape and that the rotation will disappear in about two months.

Fig. 6. Urinary stream is large size and good force.

The same principles of not having overlying lines of sutures in juxtaposition should be used in making the anastomosis between the new tube and the old. This is easily brought about by dissecting back the posterior flap. The steps of this operation for penile and peno-scrotal hypospadias are shown in Figures 3 and 4.

Figures 5 and 6 show the results obtained in using Thiersch's operation in a boy of seventeen with peno-scrotal hypospadias. The right testicle in this case has been brought down at the age of twelve and the deformity of the penis corrected at the age of thir-

teen. This boy was cured in one operation. No sinuses occurred and at no time has there been any tendency toward stricture whatsoever. The boy voids his urine in a large sized stream with normal force.

In perineal hypospadias the method of Thiersch is also the best method. Here the perineal outlet is utilized for the passage of

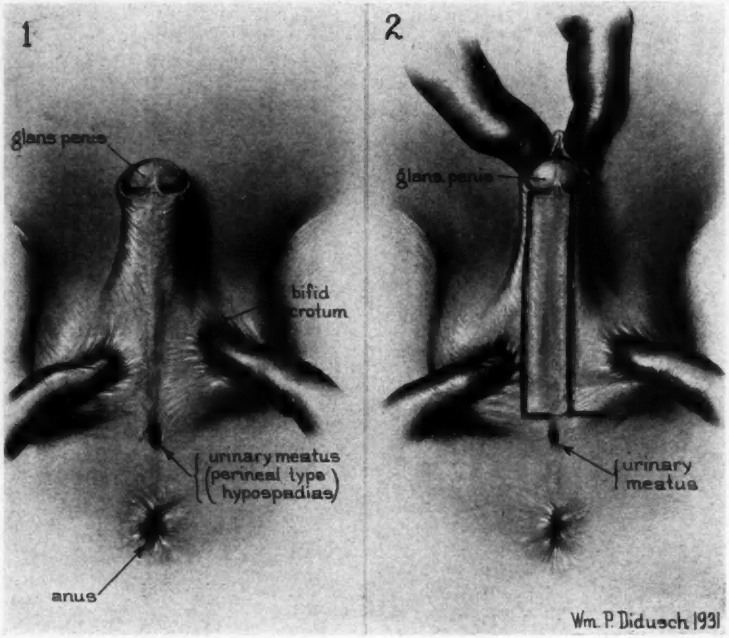

Fig. 7. Skin incision for perineal hypospadias.

urine during the construction of the urethra down to within 1 cm. of this opening. Having constructed a satisfactory urethra down to the perineal outlet a suprapubic drainage is now done and the perineal opening closed by the method of Duplay. This is extremely easy because there is considerable tissue depth at this point. Figures 7, 8, 9, 10 and 11 show a case of perineal hypospadias in which the patient was cured by the Thiersch method. Healing

took place *per primam* throughout. No sinuses occurred at any time nor were there any strictures.

In case of failure of Thiersch's method then Bucknall's operation, or one of its modifications such as the operation of Landerer and Bidder, would be useful as a secondary operation. Churchman and Harvey concluded that the operation possessed many of the

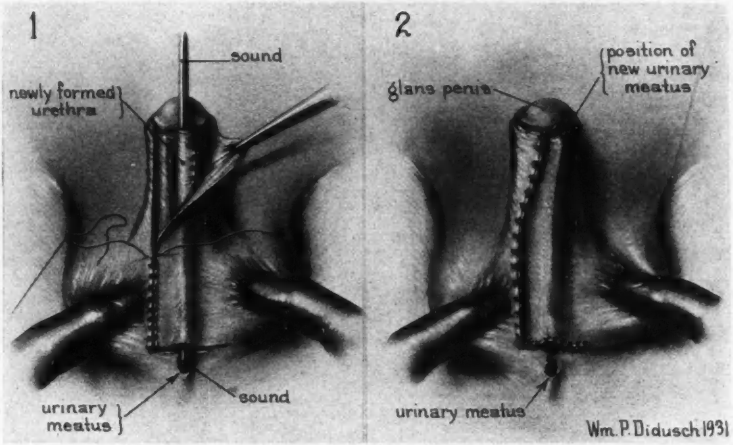

Fig. 8. Adaptation of Thiersch's method for reconstructing the urethra in perineal hypospadias.

principles for success. Where one has to deal with a patient who has had repeated operations with failures, the operation of Pickerill should be borne in mind. This operation, in one case where two previous operations for hypospadias had failed, leaving a very bad field in which to work, formed a tubular graft from the skin of the abdomen and stepped this down by stages, and from the graft secured material for the construction of the urethra.

EPISPADIAS

The earliest operators in the treatment of epispadias were concerned only with the making of a urinary channel along which the urine could flow. When Thiersch developed his flap operation

which Billroth spoke of as one of the most brilliant in plastic surgery, he noted that some of his patients gained some slight degree of control of urine and he managed to bring about a fairly comfortable living condition by a mechanical device in which pressure was brought to bear on the roof of the penis.

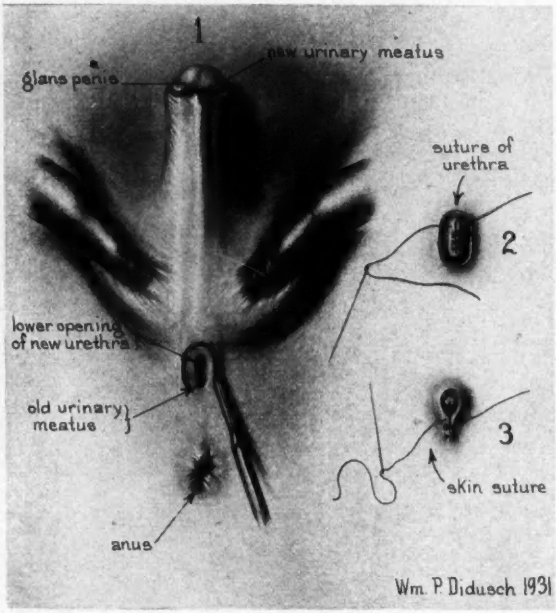

Fig. 9. Method of closing perineal wound after peno-perineal urethra has been constructed. At this stage supra-pubic drainage and suction apparatus is advisable.

It is of interest to note that Duplay, writing in 1880, stated that it was his belief that the incontinence of urine was due to a defect in the constrictor muscle at the neck of the bladder and that this might be cured by operation. Previous to Duplay's time it was not recognized that there was any possibility of bringing together the sphincter muscle or that there was one present. Duplay in one case of epispadias with incontinence brought about a complete cure

of the incontinence and stated that he had succeeded in bringing about almost a complete cure in another case.

In 1895 Cantwell described an operation for reconstructing the urethra in epispadias. In doing an autopsy on a boy who had committed suicide and who had complete epispadias he noted the ease

Fig. 10. Result of combination of foreskin graft and Thiersch operation in perineal hypospadias. Opening of the hypospadiac urethra was very short distance in front of rectum. Scarcely any scrotum. Both testicles in abdomen.

with which the cavernous bodies could be separated, and it was this that led him to the development of the operation of separating the cavernous bodies and burying the urethra down between them so that it might occupy a practically normal position. Cantwell thought that some of his patients had some improvement in the control of urination, and in this he was borne out by the observations of Parkham. Page reported a case in which complete control followed the operation, but Cantwell did not operate with any idea of restoring urinary continence.

Then in 1895 appeared a very significant article and so significant that I have quoted fully from it. Boiffin, writing on epispadias, had the following to say:

"Incontinence of urine is due to a deep division of the circular fibers of the neck of the bladder. If the two ends of these fibers could be reunited, the functions of the neck of the bladder would be restored, particularly voluntary micturition. I have used this operative plan in a youth of fifteen years, with complete epispadias and absolute incontinence of urine. First I performed a symphyseotomy on the principles

Fig. 11. Urinary stream is large size, good force.

formulated by Farabeuf. Thus I exposed for the length of five centimeters, the region of the neck of the bladder and of the prostate where the mucosa was present only along the median line. I dissected on the sides until I came to the thick fleshy parts, which I was able to suture with catgut and bring over to the median line over the mucosa, left intact at the bottom of the wound and turned back like a fold on the side of the canal. Next, I sutured the symphysis with silk, and

put a separate dressing under a bandage on the body, firmly placed. The child got up on the twenty-fifth day, with no difficulty in walking, and urinated voluntarily every two or three hours. He had removed the rubber catheter. I propose to carry his urethral canal to the end of the penis soon."

Even this author did not impress surgeons with the possibility of being able to cure incontinence with epispadias.

Another significant article of tremendous bearing on the subject is the working of Trendelenburg. In an article on Ectopia Vesicæ published in the Annals of Surgery in August 1906, Trendelenburg in working on the cure of exstrophy of the bladder stated that he had reached the conclusion that the physiological factors necessary both for retention and voluntary micturition are present and that they are merely prevented from functioning in a normal manner by certain mechanical conditions such as the pelvis attempting to go back to its former state after having been reconstructed. Trendelenburg in this article states that it is well known that in certain cases of epispadias where the infundibulum is narrow the previously existing incontinence may be overcome by direct suture of the urethra after the free edges of the latter have been freshened. He further states that in the extreme degrees where the neck of the bladder will admit the finger it is merely necessary in such cases to bring about a narrowing of the muscular ring around the neck of the bladder by an excision of a sufficiently wide wedge-shaped section from the upper border of the infundibulum and then carefully closing the gap with catgut sutures. The author's procedure consisted in cutting between the pubic bones and approaching the vesical neck in this manner. He states that enough tissue should then be removed to leave a broad bleeding surface which may then be approximated with catgut sutures. At the region of the neck of the bladder the edges are turned in and brought together with Lembert sutures. He advises using a catheter during operation but this should be removed at the close of the operation and put in a suprapubic drain which was introduced through the top of the bladder by a special opening made in the anterior wall. The suturing of the skin would then complete the operation. He states that by this operation he got a perfect result in a boy of twelve years. Neither the work of Boiffin nor the work of Trendelenburg seemed to make any great impression for we still

find many years later surgeons concerned only with the reconstruction of the urinary channel.

In 1920 Thompson attempted to use the rectus muscle for reconstructing the sphincter in a case of epispadias with incontinence. Apparently he got some result but the article does not say whether the boy was completely cured or not.

Fig. 12. Radiograph of case of epispadias with incontinence. Note marked separation of pubic bones.

In 1922 the very significant work of Doctor Young made its appearance. Doctor Young devised an operation for bringing together the vesical sphincter by suprapubic approach, and by further attack on the external sphincter beneath the symphyseal band. He invented his boomerang needle holder for facilitating these deep sutures and introduced an operation for reconstructing the urethra which was a great improvement on any operation previously devised in that while the urethra was buried to its normal position, it

was not entirely freed as had been done in Cantwell's operation. Doctor Young's work has been epoch-making in teaching surgeons that the vesical neck and the urethra in these children can be successfully reconstructed, not occasionally but in many instances, and it is the ideal to which all surgical procedures on the neck of the bladder should be directed.

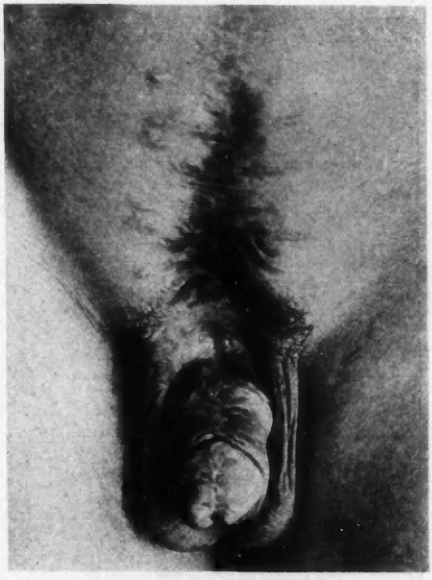

Fig. 13. Epispadias with incontinence. Reconstruction of the vesical neck and urethra to the end of the penis. Note that the penis hangs in a rather normal position in spite of the fact that no redressment was done other than bringing the corpora cavernosa together.

Muschat has reported successful cases in addition to those reported by Doctor Young, as has Sanchez-Cavisa.

Following Doctor Young's technic I have succeeded in curing one patient of epispadias with incontinence of urine. The deformity in this case was extreme, the pubic bones were widely separated. One could easily pass a finger into the bladder. There was absolutely no possibility of retention of urine. The technic used for

the reconstruction of the urethra was the method of Duplay and the vesical neck and external sphincters were reconstructed after the technic of Doctor Young. This boy is now thirteen years old and is a strong, well developed boy. He does not get up at night to urinate and voids only three or four times during the day. At one time at the office he voided 320 c.c. and there is absolutely no leak-

Fig. 14. Cure of epispadias with incontinence of urine. Note large size stream, good force.

age of urine at any time. His urine is voided in a forceful manner with perfect control. He takes an active part in school athletics. It is not necessary to say that under no other conditions could he have ever gone to school. Radiograph of this case is shown in Figure 12 and photographs are shown in Figures 13 and 14.

Other operations have been devised. Rockey, in 1928, brought about the control of urine in a boy of four by the use of the gracilis muscle as was originated by Deming.

In 1930 Dr. Hugh Cabot of the Mayo Clinic, in speaking on epispadias, stated that the present operations for this condition should as a rule be confined to those cases in which the deformity is incomplete and the sphincter at the neck of the bladder is competent. For the complete cases of epispadias with incontinence of urine he recommended the transplantation of the ureters to the bowel. It would not seem logical to consider uretero-intestinal anastomosis as a primary operation for the treatment of epispadias with incontinence but that the operation should be reserved for those cases in which it has proven to be impossible to reconstruct the vesical neck.

CONCLUSIONS

1. In attempting to reconstruct the deformities of the urethra the urological surgeon should familiarize himself thoroughly with the principles of plastic surgery.

2. No result can be obtained without an absolute diversion of the urinary stream and this is not likely to be brought about except by occlusion of the urethra by suture.

3. No drainage tubes, probes, nor any other foreign bodies should be left in the newly formed urethra.

4. The primary operation for the correction of the deformity of the penis should be done during the first two years of life. It should be complete and no other operation should be done until the deformity is proven to have been cured.

5. Heteroplastic grafts are of no value for the reconstruction of the urethra.

6. There is much experimental evidence and clinical evidence against the use of isoplastic grafts and it is very doubtful as to whether one should attempt to reconstruct a urethra from them.

7. Autoplastic free grafts such as the use of the appendix or the use of veins, arteries, or free skin grafts after the method of Nové-Josserand are very unsatisfactory in reconstructing the urethra, and although urethral canals have been made by the use of this material the results have almost universally been bad.

8. The advancement of the urethra operation of Beck is of use only in very minor degrees of hypospadias—in cases that probably should not be operated at all. In more extreme degrees of hypospadias it is likely to result in failure or in the production of a condition worse than previous to the operation.

9. Cantas' operation of using a pedicle graft of the saphenous vein has not been sufficiently tried to warrant its use. Among other objections to it is that the vein is likely to be too small or is likely to be branched.

10. The urethra has been successfully reconstructed by turning down a flap of bladder mucosa.

11. Small base pedicle grafts such as are exemplified by the Rochet method are likely to leave fistulæ at the base of the pedicle graft. They have a tendency not to join in the development of the penis and to cause retraction of the penis and in some instances contraction of the caliber of the tube.

12. The most successful method of reconstructing the urethra is by the method of Thiersch, which is applicable to all forms of hypospadias.

13. Many cases of epispadias with incontinence are curable.

14. Transplantation of the ureters to the bowel should be reserved for those cases in which one has utterly failed to reconstruct the vesical neck.

15. The best method of reconstructing the bladder neck and urethra is the method proposed by Doctor Young.

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CONGENITAL URINARY OBSTRUCTION IN MALE CHILDREN WITH REPORTS OF CASES PRESENTING UNUSUAL ANOMALIES

W. A. FRONTZ, M.D.

Baltimore, Maryland

The clinical recognition and the surgical treatment of congenital valvular obstructions of the posterior urethra date from an operation carried out by Young on October 3, 1913.

Case 1.—This patient, aged twenty months, was admitted to the Harriet Lane Home, Johns Hopkins Hospital, six weeks previously. The child had apparently developed normally until he was five months of age, when it was noticed that he had some difficulty in urination. This was attributed to a tight prepuce, but no improvement followed circumcision.

Examination at the time of admission revealed a mass continuous with the bladder which extended to the level of the umbilicus. Several unsuccessful attempts were made to pass a small catheter, the catheter always meeting an obstruction at a point just beyond the external sphincter. A filiform, however, was finally passed into the bladder after which a ureteral catheter was introduced, through which large amounts of urine were evacuated. The output of phenolsulphonephthalein was only a trace in the first two and one half hours. A thorium cystogram showed a trabeculated bladder with some dilatation of the internal sphincter and adjacent urethra, but there was no regurgitation of the fluid into the ureters.

At operation, October 3, the bladder was found to be dilated and hypertrophied. The vesical orifice was markedly relaxed and just beyond it a vertical valve-like obstruction could be felt on the left side. This diminished the urethral caliber by one-half. The valve was semicircular in outline and extended from the floor to the roof of the urethra. It was readily seized with a clamp, pulled into the bladder and destroyed with the electro-cautery. Further examination revealed no obstruction. The suprapubic wound healed rapidly and the patient left the hospital greatly improved four weeks after operation.

The second patient operated upon was admitted to the Harriet Lane Home on August 19, 1913.

Case 2.—This patient, aged twenty-one months, gave a history of attacks of retention extending over periods as long as thirty-six hours.

Examination revealed marked distention of the bladder, which reached almost to the umbilicus. After considerable difficulty a ureteral catheter was passed, recovering 500 c.c. of urine. The renal function in this case was unimpaired, the output in the first hour being 71 per cent. The urine was uninfected, but contained a moderate amount of albumin.

At operation on November 5, 1913, the bladder was opened suprapubically and found to be quite dilated and its walls considerably hypertrophied. The internal sphincter was widely dilated and the

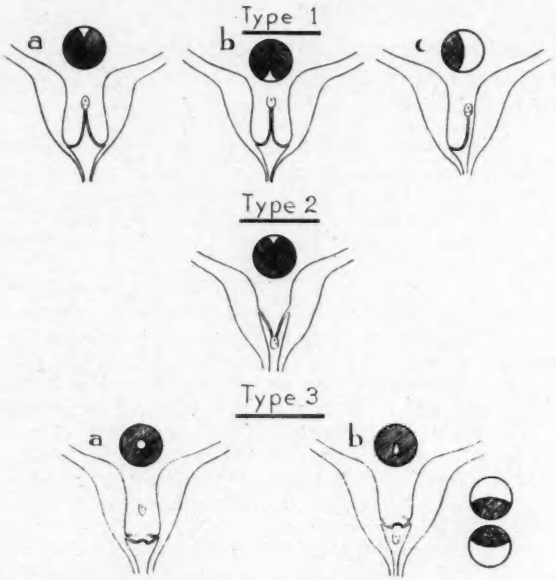

Fig. 1. Showing diagramatically the valvular types of congenital obstruction of the posterior urethra.

finger introduced through the vesical orifice met an obstruction in the region of the external sphincter. When a small sound was passed through the meatus it encountered an obstruction in the region of the external sphincter, the obstruction being caused by a fold of mucous membrane, as was demonstrated by passing the finger from above downward. Sounds were now passed from the urethra toward the bladder as well as from the bladder downward, but it was impossible to make the two sounds meet, because of the existence of this thin membranous fold. An external urethrotomy was performed and the

bulbous urethra opened. The point of obstruction lay just beyond the bulb, although its exact nature was not determined. Large instruments were passed from below and the valve-like obstruction ruptured. Both the suprapubic and perineal wounds healed rapidly and the patient left the hospital at the end of a month in excellent condition.

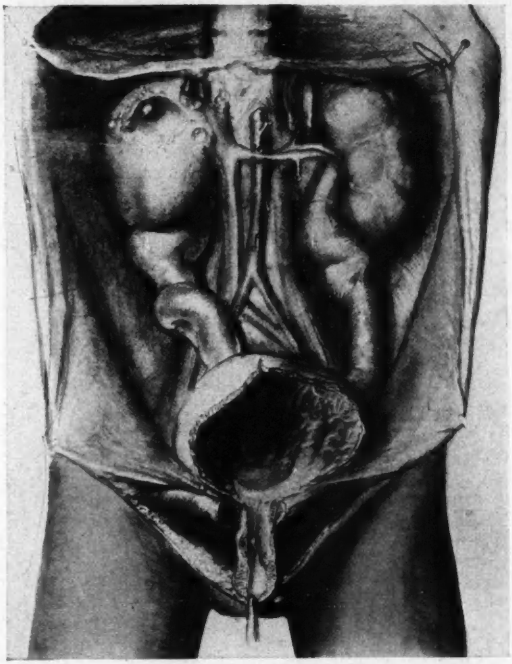

Fig. 2. Drawing of autopsy specimen showing valves designated as Type 1. Note hypertrophied crista gallia and valve leaflets extending from the verumontanum to urethral wall in region of external sphincter, the dilated bladder, hydroureters and hydronephroses.

The points of obstruction in these two patients differed considerably. In the first case the obstruction resulted from a vertical valve-like fold, extending from the floor to the roof of the urethra, which lay just outside the internal sphincter. In the second case the obstruction lay apparently well below the verumontanum.

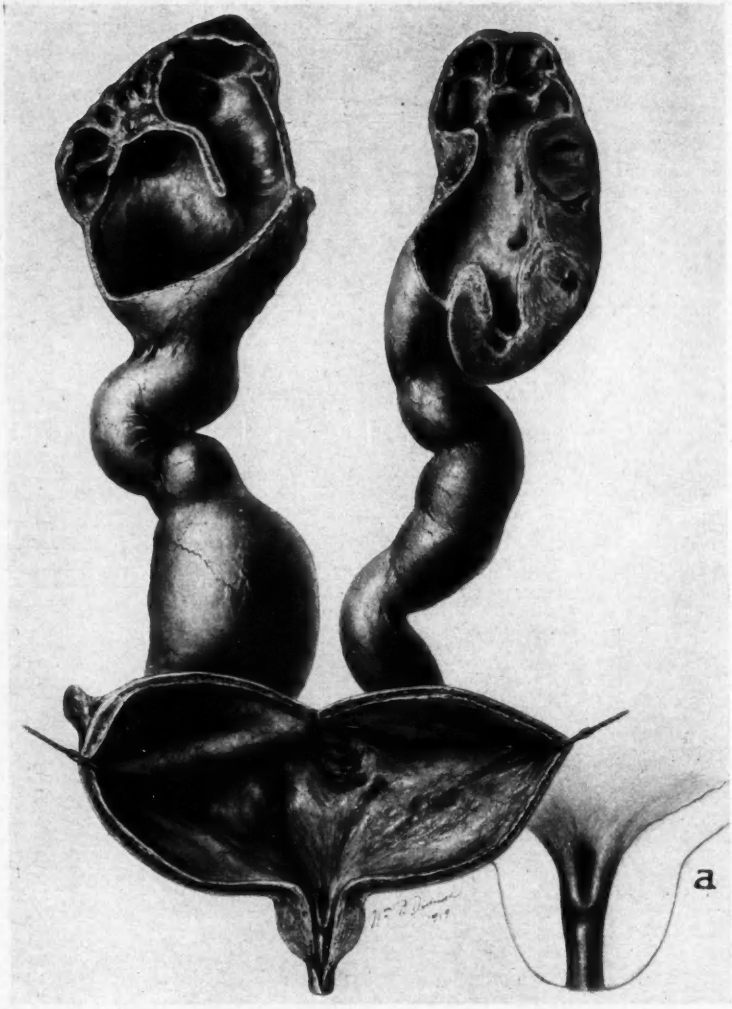

Fig. 3. Drawing of autopsy specimen, showing the remains of valvular obstruction, Type 2. Valves had been ruptured by trans-urethral instrumentation one year previously. Note dilated bladder, hydroureters and hydronephroses. Insert shows dilatation of sinus pocularis.

A study of this condition was undertaken by Young, Frontz and Baldwin in 1918, and a search of the literature revealed a reference to the condition in Langenbeck's work on lithotomy which was published in 1802. Velpeau, in 1832, likewise described several anatomical specimens in which there were present in the posterior urethra valve-like folds, which he felt might be of clinical

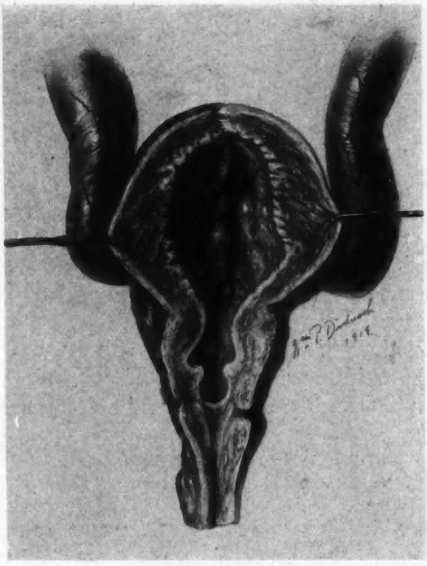

Fig. 4. Drawing showing crescentic variety of valves, Type 3. Note marked dilatation of posterior urethra, hypertrophied bladder and hydroureters.

importance. Tolmatschew, in 1870, was the first to give a comprehensive discussion to the subject and recognized the condition as a pathological entity. A study of reported cases revealed none in which the diagnosis had been made during life, all of the cases being found at autopsy. A study of these cases proved quite definitely that three types of valve formations exist, which we have designated as Types 1, 2, and 3.

Type 1.—In the most common type there is a ridge on the floor of the urethra continuous with the verumontanum, which takes an anterior course and divides forklike into two processes which are inserted into the urethral wall in the region of the bulbo-membranous junction. These processes are continued as thin membranous sheets directed upward and forward which may be attached to the urethra throughout its entire circumference.

Type 2.—In the second type there exists a condition somewhat similar to Type 1, except that the ridge passes from the verumontanum toward the internal sphincter, just outside of which it divides forklike into two processes which are continued as membranous sheets and attached to the urethral wall in a manner similar to that described in Type 1.

Type 3.—The third type may be found at any level between the two sphincters. It was first mentioned by Jarjavay, who described it as an iris valve, because of its similarity in shape to the iris of the eye. Variations of this type are found, the most common being more or less crescentic or semilunar folds which cross the urethra transversely or vertically.

It is our desire in this communication to report three cases in which the obstructions, while probably of congenital origin, differ markedly from the three types described in our original paper.

Case 3.—This patient, aged fourteen months, was admitted to the hospital on January 12, 1931. The following history was obtained from the father, who is a physician.

Very soon after birth it was noted that there was a marked obstruction to the passage of urine, which instead of being passed in a continuous stream escaped more or less continuously drop by drop. At this time no distention of the bladder was suspected. On December 27, 1930, at which time the patient was about thirteen months of age, a marked distention of the bladder was discovered. The patient apparently suffered from marked pain in the hypogastrium and his temperature ranged from 103° to 105°. Urinalysis at this time showed a marked grade of pyuria, whereas, prior to this attack, the urine had been clear and apparently uninfected. Catheter drainage was instituted, but the patient remained generally toxic and a suprapubic cystostomy was carried out on January 3, under local anesthesia. Studies of his blood chemistry prior to admission to our clinic ranged between 50 and 70 mgm. N.P.N. The phthalein had been greatly reduced, the output in two hours being less than 10 per cent.

Examination at the time of his admission revealed normal external genitalia, except they seemed unusually well developed for the patient's

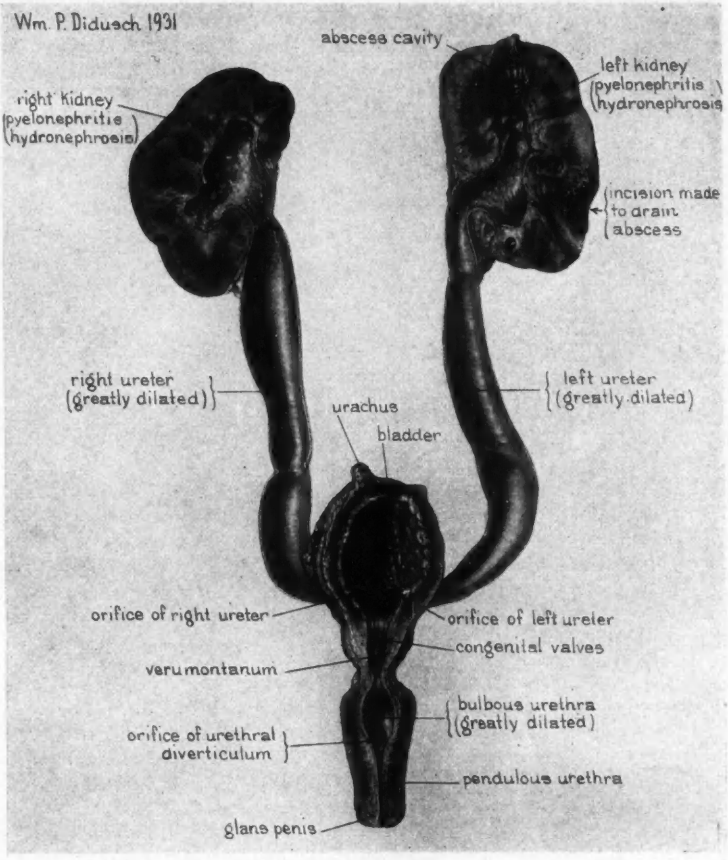

Fig. 5. Drawing of autopsy specimen, Case 3, showing diverticular orifice on posterior wall of bulbous urethra above which the urethra is greatly dilated. Note hypertrophied verumontanum from the upper surface of which spring five rudimentary mucous folds which may be classified as varieties of congenital valves, Type 2. Note also hypertrophied bladder wall, hydroureters and hydronephroses.

age. Just behind the peno-scrotal junction as the penis was drawn up over the abdomen a definite rounded tumor was visible beneath the scrotal skin. On palpation this could be very definitely outlined as a smooth, rounded structure which was readily movable laterally and apparently attached to the urethra. The overlying skin was not attached to it. It was not tender. While it was quite tense, a suggestion of fluctuation was present. When moderate pressure was made over

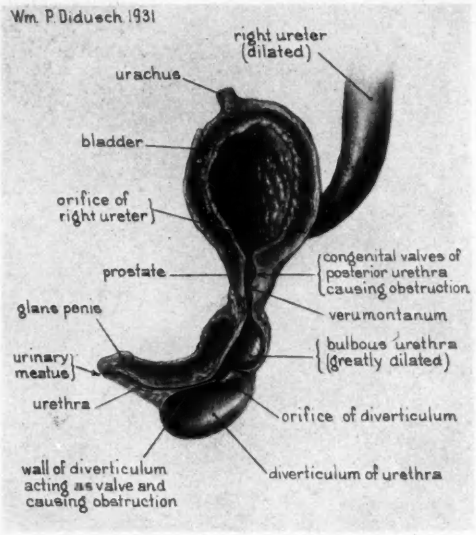

Fig. 6. Lateral view of specimen, Case 3, showing relation of diverticulum to the urethra and the valve mechanism exerted by the anterior wall of diverticulum resulting in distension of sac and compression of urethra. Note resultant dilatation of urinary tract above it.

this mass its shape and size were not altered, but when considerable pressure was applied there escaped from the urethral meatus a considerable quantity of watery pus with a collapse of the mass. It was suggested, therefore, that the condition was cystic and continuous with the urethral lumen through a rather small opening. The patient continued to run an elevated temperature and was given intravenous glucose and blood transfusions. He continued very toxic and edematous, dying in uremia on January 20, a week after admission.

At autopsy a very interesting condition was found. On the inferior wall of the midbulbous urethra was a small orifice of a diverticulum, the sac measuring about 2 cm. in diameter. There was, apparently, a valve-like fold at the entrance of the diverticulum which allowed urine to distend it, but prevented its emptying. As a result of the distention of the diverticular sac, the bulbous urethra was considerably compressed from below upward, resulting in marked obstruction to the passage of urine. The bulb immediately above this point was greatly dilated. Another interesting anomaly was found in the prostatic urethra, in the presence of a number of folds of mucous membrane which in a way resembled the valve-like folds usually referred to as Type 2. These folds were only slightly elevated above the surrounding mucous membrane and it is not likely that they played a major rôle in the obstruction. The bladder showed marked hypertrophy, its walls being at least 1 cm. in diameter. There was a marked grade of hydroureter and hydronephrosis.

It seems probable that until the onset of the infection three weeks before, the patient had a fair renal function. At this time the infection supervened, which, coupled with a mechanical obstruction, resulted in a rapid destruction of both kidneys. Autopsy showed an extensive pyonephrosis with multiple subcortical abscesses.

Case 4.—This patient, aged seven years, was admitted on January 26, 1931, with a history of having developed complete urinary retention when he was eight days old. He was catheterized at this time and shortly afterward developed what was diagnosed as acute pyelitis. He was admitted to a hospital where he remained for a period of five months, being treated by frequent catheterization, internal medication and diet. Following his discharge from the hospital he continued to void with marked frequency. There was considerable hesitancy and the urine could be voided only after marked straining. Cystoscopy was performed a few days before the patient came to Baltimore and both ureters were catheterized. Uroselectan pyelo-ureterograms were obtained which showed marked bilateral hydronephrosis and hydroureter, together with a large bladder. At the time of his admission repeated attempts at catheterization were unsuccessful. Under general anesthesia, however, a filiform was quite readily passed into the bladder, after which a No. 18 follower was introduced. A No. 16 French cystoscope was then readily passed and 500 c.c. of urine recovered. The bladder tone was very poor, the urine being expelled through the cystoscope under greatly diminished pressure. Study of the vesical orifice showed a little rounding on the right. Some gross trabeculation was noted back of the trigone, but the bladder as a whole seemed rather atrophic. The vesical orifice was somewhat contracted. The prostatic urethra, however, was quite dilated, permitting with the anterior cystoscope a good visualization of the verumontanum just

below which a crescentic valve traversed the urethra from side to side.

A suprapubic cystostomy was carried out at this time and a subtrigonal pouch, 1 cm. in depth, was discovered in the midline. The vesical orifice was elevated and the difficulty of passing instruments was immediately apparent. It seems probable that the pocket beneath the trigone resulted from instrumental trauma at some time prior to

Fig. 7. Cystogram, Case 4, showing normal bladder except for irregularity of outline. Note curious transverse shadow outside vesical orifice which stereoscopically is interpreted as being the orifice of a subtrigonal pouch.

his admission. With a small punch instrument the vestical orifice was divided and the obstruction relieved at this level. The crescentic fold below the verumontanum was removed in a similar manner. The patient's postoperative course was uneventful and he left the hospital at the end of three weeks in good condition.

Case 5.—This patient, aged six and one-half years, was admitted to the hospital on March 5, 1931, with a history of recurrent attacks of

fever for five years, which were diagnosed as acute pyelitis. No definite history of urinary obstruction was obtained, but during the attacks of fever there was marked frequency of urination. Examination of the urine at the time of admission showed pus and numerous staphylococci.

Under avertin anesthesia a No. 14 French cystoscope was readily passed recovering 500 c.c. of residual urine. Cystoscopy immediately

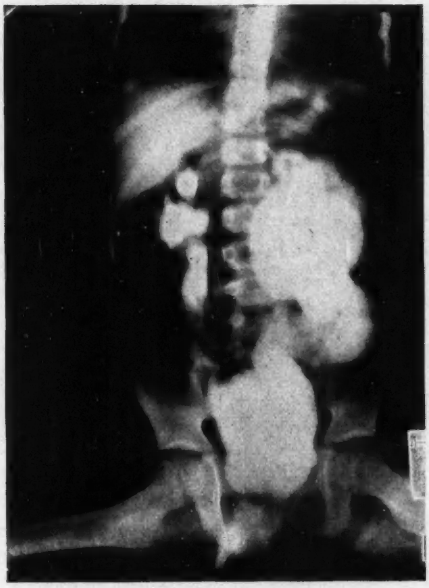

Fig. 8. Cysto-uretero-pyelogram, Case 5, showing dilated bladder, hydroureters and hydronephroses.

found a very atonic looking bladder. The trigone was flat and could not be definitely outlined. The left ureteral orifice was the golf-hole type and measured at least 1 cm. in diameter. The right ureteral orifice was slit-like, although apparently somewhat enlarged. The vesical orifice was edematous and showed no dilatation, and it was impossible to visualize the prostatic urethra cystoscopically.

The cystogram showed a large irregular bladder with bilateral hydroureter and hydronephrosis. The left ureter was of intestine-like size terminating in the left kidney, whose outline almost equalled the

bladder in size. The right ureter was also dilated throughout, measuring 1.5 cm. in its widest portion. The kidney on this side while showing some blunting of the calices was only moderately hydronephrotic.

The renal function as determined by phthalein was as follows: The appearance time was twenty minutes; output for the first half hour 20 per cent; output for the second half hour 15 per cent. The blood urea was 36 mgm. After catheterization for a week the phthalein

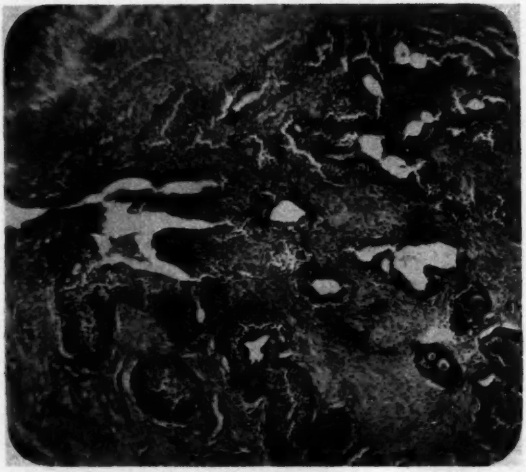

Fig. 9. Photomicrograph of specimen, Case 5, showing increase in glandular elements and smooth muscle.

showed a marked improvement, the dye appearing in five minutes. The output for the first half hour was 40 per cent and for the second half hour 30 per cent. The blood urea at this time was 28 mgm.

On April 20, 1931, a suprapubic cystostomy was carried out. Examination of the vesical orifice showed some dilatation. About 0.5 cm. outside the orifice, however, a marked obstruction was encountered in the shape of a transverse ridge which passed across the floor of the urethra. This ridge was quite firm and did not suggest a valve formation. After some difficulty the obstruction was relieved by a punch after some eight cuts had been made. The tissue removed showed a large amount of glandular tissue and what is regarded as an excess of smooth muscle. The exact pathology of the condition is problematical. The patient's convalescence was uneventful. He was discharged in three weeks, voiding as much as 600 c.c. at a time.

UNUSUAL TUMOR OF THE PENIS

HOWARD S. JECK, M.D.
New York City

In a recent study of fifty cases of epidermoid carcinoma of the penis, Colby and Smith divided them, according to their histological appearance and their clinical course, into groups of low and high degrees of malignancy. They found that at least half of them (twenty-six) belonged to the former group while the remainder (twenty-four), belonged to the latter.

Basal cell carcinoma of the penis is so rare that a cursory examination of the literature and a consultation with two capable pathologists has failed to reveal the record of a case of the relatively non-malignant type of tumor (so located), which is described in the following case report.

On September 23, 1925, a sixty-seven-year-old man came to me compaining of a small lump near the end of the penis. He was of the lean type, apparently in good health and had no other complaints. There was no loss of weight.

His past history is irrelevant.

He had noticed the lump about nine weeks before I first saw him.

Examination of the penis by inspection revealed very little. There was a very slight bulge outward just above the meatus and on separating the lips of the meatus a slight bulging in of the roof of the urethra could be detected. But apart from a slightly granular appearance of the glans and the urethral mucosa over the bulging part, the glans and urethra appeared to be normal. On palpation of the glans, however, one could distinctly outline more or less definitely an elongated mass which apparently was shaped like a jelly bean. It was about 1.5 cm. long and a little over 0.5 cm. in its transverse diameter. It did not feel hard but was firm enough to permit of definite palpation and seemed to lie on top of the urethra and run more or less parallel to it (Fig. 1).

Under local anesthesia a small piece of the lesion, including a little bit of the meatus, was removed for microscopic examination. The specimen was examined in the Cornell Medical College laboratory by Doctors Ewing and Smith, who reported it to be a basal cell carcinoma, clinically non-malignant (Figs. 2 and 3).

Since this is the type of neoplastic growth that usually responds well to radium, radium therapy was decided upon. On October 18, 1929, a

gold seed containing 1 mc. of radium emanation was implanted into the growth. I attempted to place this seed as near the center of the mass as possible. About two weeks later the patient was seen again and there was no apparent change in his condition. Five weeks after the implantation of the radium the lesion appeared to be a little bit softer, but of this I could not feel sure.

On January 17, 1930 (three months after the radium was implanted), there was apparently no change at all in the lesion. There-

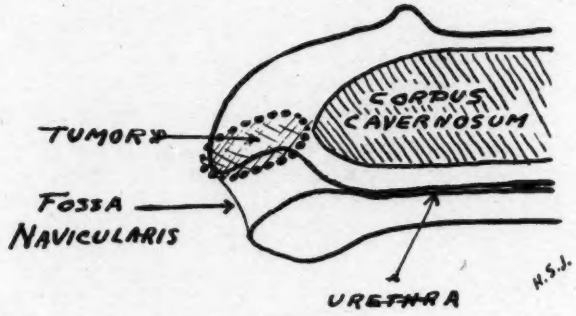

Fig. 1

fore another gold seed, this one containing 1.5 mc. of radium, was implanted and likewise as near the center of the growth as possible.

The patient was next seen on April 25, 1930, or a little over three months after the second radium seed was implanted, and again there was apparently no change. At this time another gold seed of 1.5 mc. of radium was implanted.

The next examination of the patient on June 18, 1930, or seven weeks after the third implantation of radium, showed possibly a little softening of the tumor mass, but again I could not feel sure of this. No other change was apparent. For the fourth time, therefore, another radium seed was placed within the growth. The last one also contained 1.5 mc. of radium emanation. On October 8, 1930, or approximately four months after the fourth radium implantation, the lesion had disappeared. There was no external evidence of anything abnormal and only the slightest amount of induration could be felt at the site of the growth.

The patient was last seen on December 23, 1930, at which time there was no evidence at all of the former lesion.

On March 25, 1931, a letter received from the patient's doctor, a very reliable and painstaking man, stated that there was still no evidence of the former growth and that in case it should re-appear he

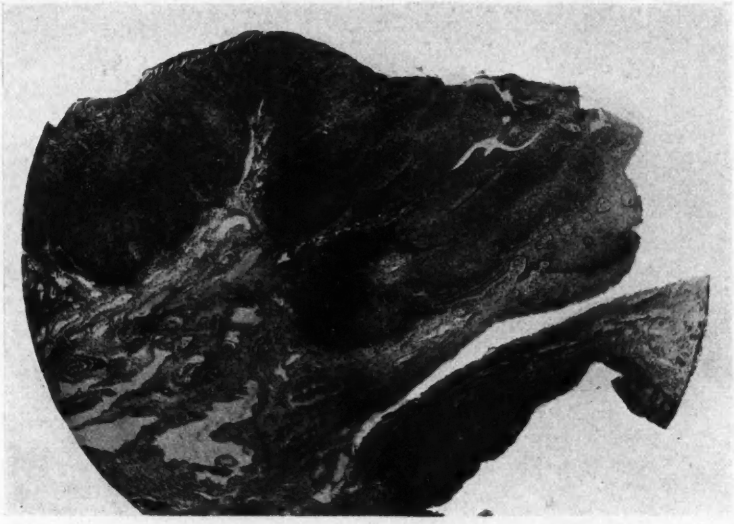

Fig. 2. Low power showing extent of tumor, sharply delimited. No invasion by the tumor cells.

would let me hear from him. So far I have received no further communication and therefore consider no news good news.

A puzzling feature of this case to me was why the radium apparently did not act more promptly. In searching about for an explanation for this, it was suggested that possibly some of the seeds might have dropped out fairly soon after having been implanted. Therefore on his visit of October 8, an X-ray was made which showed only one gold seed shadow. This seemed to confirm, at least to some extent, the idea that the other seeds did not remain sufficiently long to permit the radium to act upon the tissue.

I think there are two points which are worthy of note in this case: (1) The unusual type of tumor, and (2) its apparent resistance at first to radium and finally its apparent complete eradication by radium. But perhaps the explanation for this, namely that the first three radium seeds did not remain after having been implanted.

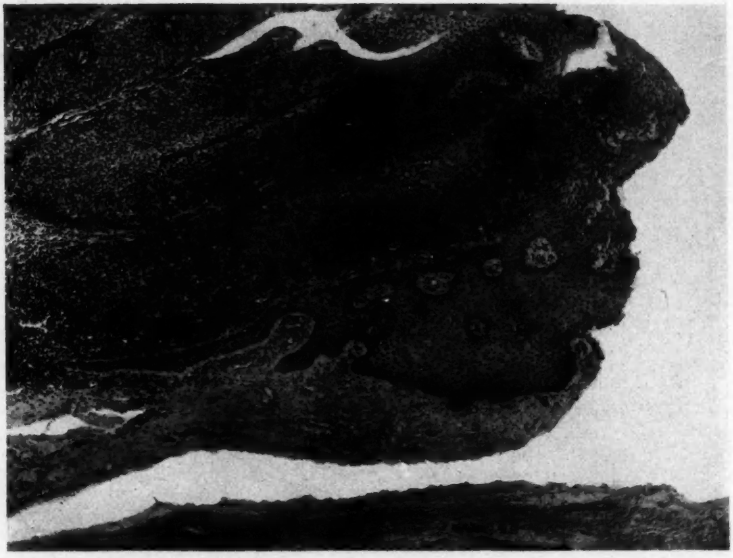

Fig. 3. High power showing basal cells (not squamous) arranged in trabeculæ. Note sharp line of demarcation, also uniformity of staining and of size of cells.

might also explain some of the failures of radium therapy which are reported.

121 East 60th Street.

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DISCUSSION

Dr. Alexander R. Stevens (New York City): I would like to say a word briefly about Dr. Smith's paper on "Traumatic Ruptures." I think that the ultimate good of these unfortunate patients is improved by immediate perineal exposure in all except those, perhaps, that have transient bleeding. I think we will have fewer late traumatic strictures with perineal drainage and urethrotomy. I think recent ruptures, either complete or otherwise, ought to be repaired immediately. The patient is no worse off for later operation if this first operation does not work. I have had several of that sort and the caliber of the urethra has been good when the patient left the hospital. I have had three cases of excision of late traumatic stricture with end-to-end anastomosis, all of whom took a No. 26 French sound without any gripping from four to six weeks afterward. In only one of these cases was I able to follow the patient afterward, and six months after end-to-end anastomosis apparently the urethra was as wide open as it had been on discharge.

I had one very interesting case of complete stricture of the posterior urethra, following an automobile acident, which involved fracture of pelvic bones. The patient came to us four months after his trauma with suprapubic opening and a group of sinuses in his lower abdominal region and inner thigh. We excised those, removed two or three pieces of necrotic bone, and then came across this stricture in the prostatic urethra which we could not penetrate either from above or below. We forced our way through and dilated until we were able to put in a No. 32 tube through a perineal incision. That was left in for two weeks. I had an opportunity of seeing that man two years afterward and he was able to take the largest sound.

Dr. Francis R. Hagner (Washington, D. C.): I think Dr. Cecil is to be congratulated upon his report of the epispadias case. It is a wonderful report.

The patient in the case I reported before the Society a number of years ago has a straight penis now, is a graduate in medicine

from Medical School this year, and is really in wonderful condition.

It has been my impression that the final operation in the straightening of the penis is better done when the patient is old enough to be able to help in a way. We have recently tried another method of straightening the penis which I believe is going to be a very successful one. It is necessary to use drainage, that is, urethral drainage, in these cases in the patients on whom this operation can be done. A cannula is passed through the corpora cavernosa and before it is passed a skin-graft is taken from the inner side of the thigh and sewed around the cannula, just as this piece of paper goes around this pencil, and a couple of stitches are put here (indicating). This is then plunged through the corpora cavernosa transversely and the edges trimmed off, leaving the skin, when the cannula is removed, inside. Then after-drainage is kept up for a week or ten days. As soon as it is healed, that is cut through below, which allows the graft to stretch out.

I would like to have some of you gentlemen try this method. I believe we are going to get better lengthening to get straightening of the penis than by any other method we have used.

Dr. George R. Livermore (Memphis): In discussing Dr. Smith's paper I would like to report an experience I had in a case of rupture of the bladder from the urethra just at the symphysis. The bladder, as if it were suspended on a pivot, simply dropped down so that the orifice of the bladder was way below the outlet of the urethra. The consequence was that when we tried to pass a catheter through the urethra it came out against the bladder and not at the bladder neck. We were concerned as to how to get that bladder up. By making a perineal incision and pushing the bladder upward, with the catheter in and with the finger through the opening we could not get the finger and the catheter to go into the mouth of the bladder at the same time, so we evolved a method of taking the ordinary catheter passer, which is like a Y, and passed that through the urethra, then pushed the bladder neck up with the finger, and with the finger guided the small instrument into the neck of the bladder. That held the bladder and the urethra in line. We then straightened out the end of the catheter

passer, which has a curved handle, and passed the catheter over the end of the catheter passer, threaded it on into the bladder and put it in place, withdrew our catheter guide and held the bladder in that position, which made a very satsifactory method of handling it.

DR. HOMER G. HAMER (Indianapolis): I want to emphasize the importance of operation in cases of rupture of the urethra. One of our patients, who had considerable bruising of the perineum and only slight evidences of traumatism of the urethra, we thought would get along pretty well on catheter drainage. It proved an erroneous conclusion for he developed an infection and died within a few days. I am convinced that operative interference should be followed in every case where a definite diagnosis of rupture of the urethra is made, that is, operation by perineal incision. If the urethra is found severed, I prefer to do an additional suprapubic section and retrograde catheterization. This is particularly true of cases of rupture of the urethra associated with the crushing of the pelvis.

Incidentally, I want to mention that two of our patients had rupture of the urethra from falling astride a manhole cover which tilted up when stepped upon.

DR. GEORGE G. SMITH (Boston): I agree entirely with Dr. Stevens and Dr. Hamer in feeling that immediate operation in these cases, whenever the patient is in condition to stand it, is the best thing.

Dr. Hamer's case was similar to one of ours in which suppuration developed after the simple placing of an indwelling catheter. I think if there is any doubt at all it is a simple and safe procedure to incise the perineum and make sure that there is adequate drainage for the lacerated tissues into which urine may extravasate.

For the late strictures I think complete resection of the scar-bearing area, with resuture of the freshened ends of the canal, is the proper procedure. Just how much can be done at the first operation in cases accompanied by fracture of the pelvis, of course, is a question that depends entirely on the general condition of the patient when he is first seen. So many of these patients are severely shocked, that the less done for them to get by the immediate emergency, is the best method.

THIRD DAY, JUNE 6, 1931

BLADDER DISTURBANCES IN RELATION TO ABNORMALITIES OF THE LUMBOSACRAL SPINE

J. EDWARD BURNS, M.D., and FERDINAND C. HELWIG, M.D.

From the Urologic and Pathologic Departments of St. Luke's Hospital, Kansas City, Missouri

In this presentation we shall consider the possibilities of interference with the different sources of nerve supply to the bladder by malformations of the lumbosacral spine. There is a group of cases of partial or complete retention of urine or incontinence, which, on cystoscopic examination, presents the same bladder picture as that found in disease of the central nervous system.

In these cases of so-called "cord bladder" we were able to demonstrate by the X-ray some abnormality of the lumbosacral spine. Either a deformed fifth lumbar vertebra, a prespondylolisthesis or increase in the lumbosacral angle, or a spondylolisthesis with or without spina bifida occulta was found. These abnormalities might cause pressure on the cauda equina, or they might cause an irritation of the presacral nerve by pushing it forward, and in this way interfere with the nerve supply to the bladder. In a fair percentage of cases of tabes, the bladder dysfunction is the first symtom of the disease. These fibers in the posterior and lateral columns of the cord seem to be especially sensitive to disease. Might they not also be unusually sensitive to pressure or irritation, and, in this way, account for the bladder alone being involved in these cases? We fully realize that it is very difficult to understand why the bladder alone should be affected by pressure on the cauda equina unless this condition exists.

Patients in this category may have a co-existent, benign prostatic hypertrophy or other true obstructive lesion. When these are removed, their bladder disturbance is as great as ever. It would therefore seem that this bladder picture must be due, at least in part, to some disturbance of innervation. This might also account for the difficulty in control or incontinence that is sometimes found in these cases after operation.

In some cases, after prostatectomy, a poor functional result of the bladder is usually considered to be due to the operation, and this may be, and often is, the cause, but there are certain cases which we believe, if carefully studied by the X-ray, will show some abnormalities of the lumbosacral spine. Often these abnormalities are found in patients who have cerebrospinal syphilis, or pernicious anemia, or some other condition which alone could be responsible for the disturbance of bladder function, but it is a question as to whether or not the abnormality of the lumbosacral spine does not also play an important part in this bladder disturbance.

ABNORMALITIES OF THE LUMBOSACRAL SPINE

The Fifth Lumbar Vertebra.—There are many variations in the morphology of the fifth lumbar vertebra within normal limits. From this, it would seem that changes in the fifth lumbar vertebra are the rule. This fact, together with the many differences in its articulation with the sacrum, necessitated by such abnormalities, would result in instability at the lumbo-sacral junction and give many opportunities for pressure on the cauda equina.

Spina Bifida.—This is most frequently found in the lumbosacral region, and in many instances is the direct cause of bladder disturbance through the development of fat pads and fibrous tissue and thinning of the nerve fibers themselves. There are many cases of spina bifida occulta in which no bladder disturbance is found, but there are likewise many which do have such disturbances that are unhesitatingly ascribed to this condition. In these two conditions, spina bifida and spina bifida occulta, many of the cases are benefited by operation.

Increased Lumbosacral Angle, or Prespondylolisthesis.—This is another important condition which might exert considerable pressure on, or irritation of, the cauda equina, especially in the hyperesthenic type of individual, and thereby cause bladder disturbance. According to Skinner and von Lackum,[7] the normal angle between a line drawn through the middle of the body of the fourth lumbar vertebra and the midportion of the body of the first sacral vertebra should be about forty-two degrees (Fig. 1). The reason the fourth lumbar is taken as an index is that it is in the mean position in the

lumbar lordotic curve between the third and the fifth lumbar bodies. In many of these plates it will be seen that this angle is greatly increased. In a case of true spondylolisthesis of Dr. F. D. Dickson, to be reported, he stated that the laminæ were found to be loose from the body of the fifth lumbar vertebra at operation. Hence, pressure from above, counteracted by resistance by the laminæ of the first sacral vertebra, might force the laminæ of the fifth lumbar ventralwards sufficiently to cause pressure on the

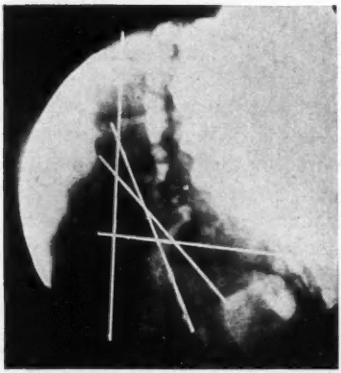

Fig. 1. Lateral view of spine showing canal very clearly and the method of measuring the lumbosacral angle.

cauda equina. When there is no separation of the laminæ of the fifth from the body, and the lumbosacral angle is greatly increased, it can readily be supposed that the increase in angulation alone would cause pressure.

Spondylolisthesis.—This is another of the malformations of the lumbosacral spine which we wish to consider. In 1853, Killan[3] originated the word spondylolisthesis from the Greek "spondylus" (spine) and "oslisthesis" (slipping out or down). This name describes quite clearly the picture of this spinal deformity, which is usually a slipping forward or downward, or both, of the fifth lum-

bar and sometimes of the fourth on the first sacral vertebra (Figs. 7 and 8). Spondylolisthesis was formerly considered very rare and was thought to be present only in women, but it has been found to occur much more frequently than was supposed, and the incidence is about equal in both sexes. In some X-ray pictures the forward luxation of the body of the fifth lumbar vertebra is so extreme that its inferior surface seems to impinge on the anterior upper margin of the body of the first sacral vertebra.

The factors which are thought to be responsible for spondylolisthesis are (1) trauma, (2) relaxation of spinous or sacroiliac ligaments, (3) paralysis of the lumbar muscles, and (4) congenital insufficient ossification of the vertebral arch resulting in its elongation, or actual non-union of its "inter-articular" portion. In our opinion this latter is the one and only important cause of this condition. Neugebauer[6] has added one important point to those already listed, as due to superimposed weight and bony change due to pressure. Another important displacement is that of the sacrum, the upper part of which may be displaced forward, frequently due to non-union of the spinous processes with the vertebral body. The former may remain in place and the body only slip forward. Whatever the cause may be, one of the results obtained, should the forward slipping of the vertebral body be sufficient, would be a narrowing of the diameter of the vertebral canal in the region of the fifth lumbar spine. Hence, it would appear that there would also be distortion, both by flattening and narrowing of the foramina from which the nerve roots emerge in this region, causing pressure on the nerves. In all these abnormalities increased mobility and instability at the lumbosacral juncture are present, either because of involvement of the fifth lumbar vertebra or of the first sacral segment. Such increased mobility of the arch or posterior part of the vertebra presents change of position which, under stress of weight bearing or movement, will readily give rise to displacements sufficient to cause pressure by the movable parts on the cauda equina. There is often found, particularly in spina bifida occulta of the first sacral segment, an area in which the subdural space is enlarged and the dura protected only by a fibrous covering so that it would seem vulnerable to pressure. When we consider the complex innervation of the bladder and its sphincters, as will be shown later, and also the centers for the control of urination, we can readily

see the great possibilities of nerve disturbance and consequent bladder dysfunction that might arise from such a cause.

Learmonth and Braasch,[5] according to their report on resection of the presacral nerve in one case, evidently think that the nerve disturbance causing the bladder dysfunction is entirely a sympathetic nerve affair. We, however, feel, after examining lateral views of the spine in the lumbosacral region in these cases of so-called "cord bladder," that the nerve disturbance may take place within the cauda equina due to pressure caused by a very definite narrowing and distortion of the canal at the juncture of the fifth lumbar vertebra with the sacrum. Another clinical evidence which would suggest that the nerve disturbance takes place in the cauda equina itself, is the relief of urinary retention, and so forth, by the relief of pressure on these nerves following the application of a brace, or by fixation of the spine by bone graft.

The question which confronts us is the manner by which any forward luxation might mechanically cause pressure disturbing the extrinsic nerves of the bladder. These nerves may be divided into sympathetic, parasympathetic and somatic groups.

On superficial analysis, it would seem that pressure from such a protruding fifth lumbar vertebra on the sympathetic ganglia would have little effect on the bladder, since there are so many inter-relating ganglia higher up which send out branches to the presacral nerve, although the presacral sympathetic does contain fibers which have inhibitory action on the muscles of expulsion in the bladder as well as motor fibers to the internal sphincter. Theoretically, it would not seem that pressure here alone would be sufficient. Nevertheless, since the fifth lumbar segment is low down, most of the impulses arising higher up would be accentuated by pressure at this point. It is known by physiologists that section of the sympathetic fibers and stimulation of the distal end will cause dilatation of the bladder and spasm of the sphincter, and it has also been observed that stimulation of the proximal cut end will also cause bladder dilatation, and resection of the sympathetic itself, as stated by Learmonth[4] does not cause any disturbance in the act of micturition.

In our cases, on cystoscopic examination, the cystoscope could be readily withdrawn into the prostatic urethra and the verumontanum plainly seen, thus showing the internal sphincter to be def-

initely dilated. It would appear, therefore, that, should the cause of the retention be due to sympathetic hyperirritability through the presacral nerve, the sphincter should show hypertonicity rather than relaxation, since motor sympathetic fibers are sent out from the presacral nerve to the internal sphincter.

Pressure on the fifth lumbar nerve, where it makes its exit, can be ruled out, since it gives off no visceral branches to the hypogastric ganglia, although rami to the sympathetic ganglia are found. It would also seem, on anatomic grounds at least, that any pressure on the lumbar cord caused by slipping forward or narrowing the canal could not exert any influence on the bladder without other very obvious peripheral disturbances. Likewise, it would appear that pressure affecting the bladder centers in the cord could be ruled out, since the visceral afferent neurones, whose axones reach the urinary bladder by way of the pelvic nerves, are said to be located in the same segments of the spinal cord from which the pelvic nerves arise. It would also seem essential that any abnormality which would affect the bladder through the second, third and fourth sacral nerves would, of necessity, be forced to act upon both the somatic and visceral portions, which division takes place outside of the cord.

Three explanations might be considered in the production of the so-called "cord bladder" when spondylolisthesis is present. First, if a spina bifida occulta is present, which is frequently the case, in conjunction with a spondylolisthesis, should the former be combined with any of the following factors as outlined by Brickner[1]: (a) meningocele protruding through the bony cleft causing pressure on the second, third and fourth sacral nerves; (b) closure of the cleft by a tough membrane adherent to the skin with similar pressure phenomena; (c) perforation of the membrane by a dense band attached to the subcutaneous tissue externally and compressing the cord structures internally; (d) fatty tissue lying within the canal concealed by this membrane and exerting pressure; (e) exostoses within the canal compressing the cord structures; (f) a so-called fibrolipoma extending through the cleft into the bony canal compressing the cord and its roots, and (g) degeneration of the cord tracts themselves. Therefore, if a spina bifiida occulta is present, combined with any of the above factors, it would appear that it should be far enough down in the sacrum to cause pressure

on the sacral divisions of the nerve, in which case, since these have as yet not divided into somatic and parasympathetic divisions, disturbances to the distribution of the somatic division would occur.

Secondly, it does not seem likely that pressure on the cauda from spondylolisthesis in the region of the fifth lumbar could affect the bladder alone. In tabes and pernicious anemia, however, where we feel sure that the disturbance is in the cord, not infrequently bladder disturbances may be an early and only symptom. Therefore, if spondylolisthesis alone, causing canal narrowing and cord pressure, were responsible for the bladder disturbance, it would be necessary to hypothesize a selective type of cord degeneration or irritation.

The third possible explanation is somewhat problematical, *i.e.*, irritation of the sympathetic ganglia through pressure from forward slipping of the body of the fifth lumbar vertebra might be sufficient to cause an inhibition to the muscles of expulsion in the bladder as well as hypertonicity of the internal sphincter, both of which might have some influence in causing urinary retention. In our cases the internal sphincter was relaxed, which would seem to disprove a sympathetic hyperirritability.

One of us[2] has shown by cystogram in known diseases of the central nervous system that the internal sphincter is very definitely dilated and the posterior urethra is funnel shaped. After dilatation of the urethra or intraspinal therapy, it was quite definitely demonstrated by cystogram that the funnel shape of the posterior urethra was obliterated and that the internal sphincter was closed. This showed that the tonicity of the internal sphincter could be restored either by peripheral stimulation, by dilatation of the urethra, or through central stimulation by intraspinal therapy. Increased tonicity also occurs in these cases where the urethra is dilated and the bladder is drained and irrigated, as well as when the pressure on the nerves in the spinal cord is removed.

In consideration of the foregoing findings we feel that a thorough study of this matter in conjunction with the orthopedist will probably produce some alleviation of the cause of such spinal nerve disturbance.

Case 1.—E. B. P., aged forty-eight years, complained of difficult urination, getting up at night to void, and decrease of sexual power. Family and past history were unimportant, except that the patient was operated upon for hemorrhoids and fistula in ano ten years ago.

The patient had five attacks of gonorrhea between the ages of sixteen and twenty-four. He had a primary luetic lesion at eighteen years of age, but no secondaries. He was given mixed treatment by mouth for seven months; none since. Sexual power had been markedly decreased for the past eighteen months, especially the last six months.

Present illness began seven years ago, at which time the patient first noticed difficulty in starting to void. This condition gradually increased until five years ago, since which time he has had to void in a sitting posture. The patient voided about twice during the day and twice at night. He said he never felt as though he emptied his bladder completely. The urinary stream was weak and dribbling most of the time, but of fair size in the morning. There was no incontinence nor complete retention.

General physical examination revealed nothing of importance except that his knee jerks were exaggerated. Pupils were equal and reacted to light and accommodation. On rectal examination the anal sphincter was found to be of poor tone and a well marked chronic prostatitis and seminal vesiculitis were present. Urine examination was negative except for an occasional white blood cell and a few red blood cells. There were no bacteria. Prostatic secretion contained 75 per cent white blood cells. Blood Wassermann was negative. On cystoscopic examination the bladder wall was trabeculated, the trigone reddened and edematous, and the cystoscope could be withdrawn into the posterior urethra, and the verumontanum plainly seen, showing the internal sphincter to be dilated. Lateral and antero-posterior X-ray films were made of the lumbosacral spine and showed a 62 degree angle between the vertical plane of the spine as registered by the third and fourth lumbar bodies and the plane of the sacrum. The orthopedic consultant reported that the movements of the spine were perfectly normal in every way. His X-ray report was (1) spina bifida occulta, first sacral segment, (2) poor articular processes of lumbosacral joint, (3) marked increase in angle between fourth and fifth lumbar, which latter follows the sacrum very closely. There was apparently a narrowing down of the intervertebral discs between the third and fourth, and the fourth and fifth lumbar vertebræ. The treatment recommended was stretching and a cast, which the patient refused.

As treatment the patient was given prostatic massage, bladder irrigations and urethral dilatations with a Kollman dilator to 30 F. This treatment was given for six weeks, during which time the residual urine varied from 160 to 20 c.c. The patient stopped coming for treatment and I was told two years later by an internist that he had been under treatment by him for cerebrospinal syphilis, his blood and spinal fluid Wassermann tests having been positive.

Case 2.—W. M. O., aged fifty-eight years, complained of inability to void.

Family history was unimportant, except that the mother died of cancer of the liver. Past history was unimportant, except that the patient complained of what he called muscular rheumatism. Two years ago the patient had cardiac decompensation which lasted two months.

The patient had noticed lately that the urinary stream began to get weaker in size and force. There was frequency of urination accompanied by pain and burning. He had had to be catheterized for four days. He had been getting up at night to void for over thirty

Fig. 2. Lateral view of spine showing marked sacral inclination with a true prespondylolisthesis, and a distinct narrowing of the foramen between the fifth lumbar and first sacral and a distinct narrowing also of the spinal canal with an increase in the lumbosacral angle. Nature has thrown out an exostosis to take care of weight distribution.

years. The patient was a rather poorly nourished, somewhat anemic looking man. Pupils reacted to light and accommodation, but it was impossible to elicit knee jerks. Nothing else of importance was found on general physical examination. On rectal examination the anal sphincter was found to be of good tone, and a moderate grade of chronic prostatitis and seminal vesiculitis was found to be present. On cystoscopic examination no intravesical enlargement of the pros-

tate was found. The median portion of the prostate was slightly elevated above the trigone in the form of a rounded median bar. The trigone was reddened and edematous, as were both ureteral orifices. The bladder wall was trabeculated throughout and the internal sphincter dilated. An X-ray examination showed a beginning spina bifida occulta at the fifth lumbar vertebra and a tilting forward of the body of the fifth lumbar vertebra on the sacrum, a prespondylolisthesis (Fig. 2). Blood Wassermann was 2 + positive. The Kahn test was negative. The patient was seen by an orthopedic consultant, who

Fig. 3. Lateral view of spine showing a moderate amount of prespondylolisthesis or increased sacral inclination. There is a narrowing of the foramen between the fifth lumbar vertebra and the sacrum with apparently some narrowing of the canal at this point.

agreed that the bladder condition was due to a lumbosacral abnormality and recommended a brace. At first the patient had a retention catheter and continuous urinary drainage. The catheter was removed in about a week and the brace applied. The patient was discharged from the hospital in twenty-five days with no residual urine. There was still some urinary infection present, and the prostatic massage and bladder irrigations were continued at intervals for two and a half months. His urethra was also dilated with a Kollman to 30 F. During his stay in the hospital his red blood count was 4,500,000.

Later he was seen by an internist who thought he had evidence of primary anemia, and put him on liver extract.

Case 3.—F. E. W., aged forty-nine years, complained of burning on urination, which began two and a half months previous to his seeking medical aid. At that time the patient had fever which lasted about a week. He also had dizziness and swelling of the lip and tongue at that time and the urine was quite cloudy. Six weeks before, the patient began having burning on urination and burning when he would hold his urine too long. This condition had persisted but improved by treatment. There were no other urinary symptoms. Appetite was good. The patient was constipated, and had lost 17 pounds in weight since the present illness began.

General physical examination was negative, except for chronic prostatitis. The urine examination showed albumin 2 +; white blood cells 3 +; bacilli, 3 +, and was cloudy in all three glasses. Prostatic secretion showed white blood cells, 85 per cent. Blood Wassermann was negative. On cystoscopic examination the bladder capacity was 600 c.c. and the residual urine 250 c.c. There was no intravesical hypertrophy of the prostate but the trigone was greatly hypertrophied, reddened and edematous, as were both ureteral orifices. There was also hypertrophy of the ligamentum interuretericum. The bladder was trabeculated. There was slight elevation of the median portion of the prostate above the trigone. The internal sphincter was dilated. A cystogram showed a large bladder shadow filing the entire pelvis with irregularity of its outline, due to trabeculations of the bladder wall. Total phthalein test gave appearance time, 10 minutes; first hour, 25 per cent; second hour, 55 per cent. On ureteral catheterization the urine from each kidney was normal and uninfected. The pyelograms were normal. Blood chemistry was normal. Eye grounds were normal. X-ray examination of the lumbosacral spine showed the angle to be more acute than normal (Fig. 3).

This patient has been under treatment nearly four years. The treatment consisted mainly of prostatic massage, bladder irrigations and dilatations of the urethra with a Kollman dilator. At times the median portion of the prostate has been fulgurated with the high frequency current. The residual urine has varied from 375 c.c. to 25 c.c. The prostate has decreased in size and the prostatic secretion contains much less pus. The urine is clearer but still infected.

Case 4.—R. S. G., aged sixty-two years, complained of urgency and frequency of urination.

Family and past history was unimportant, except that the patient had two attacks of gonorrhea, one at eighteen and the other at thirty years of age. Present illness began two years ago. At that time the patient had an attack of diurnal frequency which lasted one week and cleared up under treatment, consisting of urotropin by mouth. Since

that time the patient had been perfectly well until a week ago, when the frequency of urination began again, this time accompanied by urgency and pain and burning on urination. Ten years ago the patient had his urethra dilated with sounds on account of smallness of urinary stream. There were no other urinary symptoms. Appetite was good, bowels were regular, and there had been no loss of weight.

Fig. 4. Antero-posterior view of the spine showing a mild degree of spina bifida occulta involving the first sacral with some extension to the fifth lumbar vertebra. There is a sacralization of the fifth lumbar and a defective articulation between the fourth and fifth lumbar on the left side with rotation and tilting of the fourth lumbar vertebra.

Fig. 5. Lateral view of spine which is difficult to interpret because of the abnormality seen in the anteroposterior view. There is, however, a definite suspicion of abnormal relation between the fourth lumbar and sacralized fifth with marked narrowing of the intervertebral disc between the fourth and fifth lumbar vertebræ and what appears to be a narrowing of the canal. This plate also shows an isolated exostosis on the lower margin of the body of the fourth lumbar vertebra which, since it is isolated, is probably compensatory to take up for the deformity.

General physical examination was negative except that a well marked chronic prostatitis and seminal vesiculitis was found. On catheterization 500 c.c. residual urine was found which contained albumin, 1 +; white blood cells, 3 +; red blood cells, few; bacilli and cocci. Urine was cloudy in all three glasses and contained shreds. Prostatic secretion showed white blood cells, 90 per cent.

Cystoscopic examination showed a bladder capacity of 450 c.c. This examination was made one week later and after the patient had had continuous drainage through a retention catheter for several days. The prostatic margin was quite edematous, but the median portion of the prostate seemed slightly elevated above the trigone. The trigone was atrophied and reddened. Both ureteral orifices were normal. The bladder wall showed fine trabeculations throughout and was somewhat reddened. There was marked dilatation of the internal sphincter. The X-ray film showed normal kidney outlines. There was sacrali-

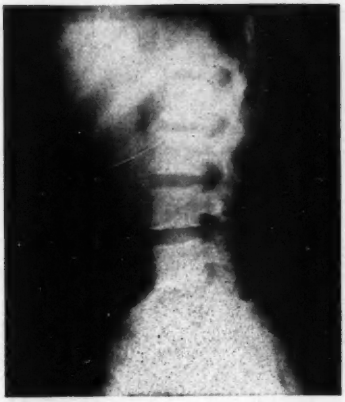

Fig. 6. Lateral view of the spine showing a fracture of the pedicle of the fifth lumbar vertebra with depression of the laminæ and narrowing of the spinal canal.

zation of the fifth lumbar vertebra and a spina bifida occulta (Figs. 4 and 5). Blood chemistry was normal. Blood Wassermann was negative. Spinal fluid, cell count, globulin, Wassermann, and gold chloride were negative. Total phthalein test gave appearance time, ten minutes; first hour, 55 per cent; second hour, 30 per cent. The patient has been under treatment five months, during which time he has received prostatic massage, bladder irrigations and dilatation of the urethra with a Kollman dilator. The residual urine has varied from 700 c.c. to 25 c.c. The white blood cell content of prostatic secretion has dropped to 40 per cent. The prostate is smaller and firmer in consistency. Urine is clearer but still infected.

Case 5.—M. S., aged twenty-eight years, complained of painful back and paralysis of the legs.

March 25 the patient was run over by a truck, since which time he had had a paralysis from the waist down. For the first two days after the accident he had complete retention of urine and had to be catheterized. He completely recovered from this, however, and now had complete control of defecation and urination.

The patient had complete motor paralysis from the hips down. There was some spasticity of the quadriceps extensors on both sides. Knee jerks were present and active. The plantar reflex was normal and the testicular reflex normal. The X-ray films showed a fracture of the pedicle of the fifth lumbar vertebra (Fig. 6).

Operation was performed for decompression of fifth lumbar vertebra. Under general anesthesia the fifth lumbar vertebra was exposed. The laminæ were intact but were depressed as a whole, particularly toward the upper end. The laminæ were cut away and distinct compression of the cord by the upper margin of the lamina was found. This was entirely freed. The dura ruptured and a large amount of spinal fluid escaped under pressure. It was impossible to close over the dura as it had disappeared, so a covering was made of muscle and fascia. The spinous processes were sutured together in contact and the wound closed in layers and traction applied.

Case 6.—R. M., aged sixteen years, complained of paralysis of the legs, pain in the lower back, and inability to void.

The patient was normal until he was six years old. He then had pain in the lower part of the back and became paralyzed in both legs. He could not void and had to be catheterized. Two months later he was able to walk but his legs were drawn. He has since been able to walk with some effort, but the chief complaint was constipation and inability to control urine completely.

General physical examination revealed nothing of importance except spasticity of the adductors and some of the flexors of the knees, chiefly of the right knee. The patient had a hollow back.

A back brace was recommended to try to correct the back condition and lengthening of the adductors, and possibly of the hamstrings on the right side. Under this treatment the left leg improved definitely, but the patient still had spasticity of the adductors and hamstrings on the right side. He received bladder irrigations. X-ray examinations showed a true spondylolisthesis (Fig. 7).

Operation was performed for stabilization of the fourth and fifth lumbar vertebræ. Under general anesthesia the last three lumbar vertebræ and the upper part of the sacrum were exposed. The fifth lumbar vertebra was extremely loose, that is, the laminæ and spinous processes were united in one piece, but apparently there was a failure of union with the anterior part of the vertebra. The laminæ and spinous processes could be moved about very freely. Typical Hibb's

stabilization was done and an osteoperiosteograft taken from the tibia was added. The wound was closed in layers and traction applied. Later a body cast was applied in hyperextension. This was removed in two months and a brace applied. The patient has now a fair control of his urine. He is catheterized once a day and has 120 c.c. of residual urine. The residual urine before operation was 600 c.c.

X-ray film of the spine at the present time shows good stabilization, but there is still considerable spasticity of the adductor muscles of the knees. Knee jerks and plantar reflexes are normal. Cremasteric reflexes have been reduced. There is no disturbance of sensation of the limbs and buttocks and perineum. The anal sphincter has good tone. The patients walks fairly well.

Fig. 7. Lateral view of spine showing true spondylolisthesis of fifth lumbar vertebra with failure of union of the arch of the vertebra to the pedicle and body. The angle of sacral inclination is almost a right angle.

TREATMENT

The treatment is a combination of orthopedic and urologic procedures. Without orthopedic treatment for correction or stabilization of the spinal deformity little can be hoped for in the way of

permanent improvement of the bladder condition. The orthopedic treatment consists first of stretching and correction of the spinal deformity as far as possible. The patient is placed on a frame, with traction, to correct the deformity. Then a plaster cast or brace is applied. If this method does not correct the deformity, then a stabilization of the spine is in order. The urologic treatment is directed first to the relief of residual urine and infection,

Fig. 8. Lateral view of spine showing a good example of spondylolisthesis of the fourth and fifth lumbar vertebræ.

for if this is not done an ascending pyelonephritis will occur sooner or later. After this, dilatation of the urethra should be done at regular intervals, with the hope of restoring the tonicity of the internal sphincter. The chronic prostatitis usually present should also be treated by prostatic massage followed by bladder irrigations. Most of these patients have infected bladder urine when first seen, and ureter catherization should be avoided if possible, for these people seem to be especially susceptible to kidney infection.

SUMMARY

1. We do not mean to say that these abnormalities of the lumbosacral spine always cause a "cord bladder," but in this series of

cases under our observation, abnormalities of the lumbosacral spine were found.

2. In our opinion, none of the cases in our series showed sufficient spondylolisthesis to cause irritation to the presacral nerve.

3. In all these cases the cystoscopic picture was the same as that in known cases of disease of the central nervous system.

4. Abnormalities of the lumbosacral spine were demonstrable in all the cases.

5. We believe that such abnormalities, by their instability and distortion of the spinal canal, cause pressure on and interference with the nerve supply to the bladder.

6. These cases are improved by the proper urologic and orthopedic treatment.

We wish to thank Dr. F. D. Dickson for the use of two orthopedic cases from his service, and for his kindly advice as an orthopedist. We also wish to thank Dr. E. H. Skinner for his help from a roentgenologic standpoint.

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FUNCTIONAL INCONTINENCE OF URINE IN WOMEN

REPAIR BY A MODIFICATION OF KELLY'S OPERATIVE TECHNIC

VINCENT J. O'CONOR, M.D.
Chicago. Illinois

There have been many operations devised to correct functional incontinence of urine in women. The type which is associated with the correction of marked relaxation of the vaginal outlet, cystocele, rectocele and prolapse of the uterus is widely recognized and frequently applied successfully. There are many women, however, with partial or complete urinary incontinence in whom the cystocele is not marked or is entirely absent. These patients are frequently allowed to continue in this condition when a simple, non-mutilating operation would entirely relieve this annoying and troublesome situation. The incontinence is accentuated by increase in intra-abdominal pressure associated with physical exertion, coughing, laughing and sudden change of position. In these persons the incontinence is partially due to interference with the sphincter itself and also to a sagging of the urethra and neck of the bladder from its normal position, due to the weakness of the musculofascial sheet that normally supports it.

In diagnosing this condition one must carefully exclude diseases which destroy the tonicity of the bladder sphincter by faulty innervation, *i.e.*, tabes, arteriosclerotic lesions of the lower spinal cord, spina bifida occulta and other less common conditions. The incontinence due to longstanding urinary infection without actual muscular relaxation must also be recognized, as these individuals need no plastic correction and are usually cured by clearing up the infection and lessening the irritability of the vesical sphincter.

The operation originally described by Howard A. Kelly for "reefing" the vesical sphincter is the most simple and efficient manner of restoring complete urinary control in these individuals where extensive plastic procedures on the vagina are unnecessary.

The modification of his technic hereinafter described was first used by me in October, 1920, and has been so gratifying in its ap-

plication and results that I wish to present it in detail to this society.

Operative Technic.—The patient is placed in the lithotomy position with a wide sandbag under the hips. The posterior wall of the vagina is retracted and the vesicovaginal septum is pulled down-

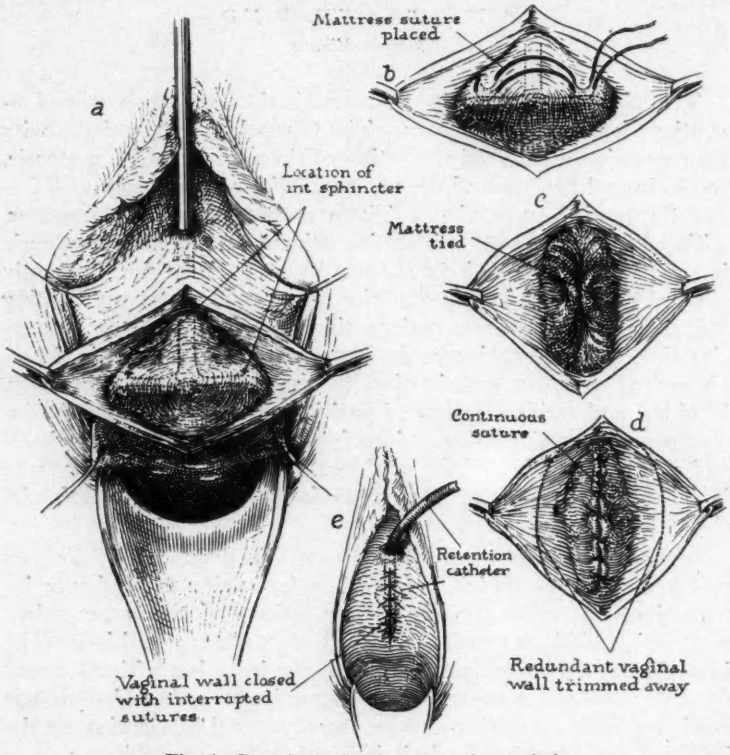

Fig. 1. Drawings showing operative technic.

ward and forward by traction on the cervix with a tenaculum. The straight Young prostatic tractor is introduced through the urethra into the bladder and the blades opened. The tractor is then pulled forward so that the blades impinge on the vesical orifice and by downward and forward traction serve a double purpose. The trac-

tor pushes the bladder floor downward and forward more easily than it can be pulled by tenaculi or forceps applied from below and obviates the difficulty of tearing away when pulled upon. It also, by the position of the blades, makes it easy to determine the exact position of the bladder sphincter and facilitates the placing of the overlapping sutures. The anterior vaginal wall is now incised for about 5 cm. in such a manner that the bladder neck occupies the center of the incision. The dissection can readily be carried out, without danger of incising the urethra or bladder, by palpating the position of the tractor. By lateral blunt dissection the vaginal wall is sufficiently detached on either side so that the neck of the bladder and upper half of the urethra are freed. Very slight bleeding is encountered by carefully following the line of cleavage. The dissection is carried furthest along the palpable blades of the tractor which outline the vesical neck. The relaxed tissues adjacent to the blades are secured by three mattress sutures of No. 2 chromic catgut carried from side to side. Pressure from above on the tractor at this time aids greatly in the ease of properly placing the sutures. The tractor is then removed and the sutures tied separately. The firmer tissues on each side of the urethra are then drawn together by two mattress sutures of chromic catgut. This gives a firmer posterior urethral wall. The redundant vaginal wall is then cut away on each side and the vaginal tissues are approximated in two layers, using a continuous fine chromic catgut suture. A small special mushroom catheter is then introduced into the bladder with a stylet. This is held in place for from five to seven days and serves to keep the bladder empty and at rest. Following stylet removal of the catheter, these patients void normally and control is usually complete from the first urination.

I have employed this operation sixteen times in the past ten years with good results. All of these women had restoration of urinary control. Two have had very slight loss of urine when very fatigued but at other times complete control. Fourteen have no incontinence. The etiology of the relaxation in these sixteen is listed as follows: Postparturition (one to ten years), eleven; following instrumental removal or crushing of bladder stone, three; following transurethral diathermy for papilloma of internal orifice, one; following an automobile accident, without local trauma, in an obese unmarried woman, one.

INJURIES OF THE BLADDER INCIDENT TO SURGERY

H. G. HAMER, M.D.
Indianapolis, Indiana

The literature contains many reports of injuries to the ureters during surgical operations upon abdominal organs, but the records show comparatively few reports of injuries to the bladder during such operations. Graves[6] found in the records of Carney Hospital, Boston, that there were in a period of five years five cases of bladder injury in a total of 19,215 admissions. Two patients were injured during surgical operations. He quotes Peacock and Hain, who reported twenty-eight cases of injury to the bladder, two (7.1 per cent) of which were due to surgical accident. Practically all authors upon the subject of wounds of the bladder and rupture of the bladder from accidents such as blows, stab wounds, bullet wounds and punctures from falls upon sharp objects and penetration by a fragment of fractured pelvic bone, mention the possibility of such injuries during surgical operations. Thus authors of articles on abdominal and pelvic surgery mention the occasional occurrence of accidental injury to the bladder during operations upon the uterus and adnexa and in the repair of hernia. No doubt the injury to the bladder has often been regarded as an incident not of sufficient importance to be worthy of special mention. This may partially explain the scarcity of reports of this injury. In some instances the seriousness of the injury may be recognized and efforts made to correct it with the hope that good fortune may avert serious consequences or embarrassing notoriety. Fortunately most of these accidents are observed immediately and appropriate repair by suture and drainage of the bladder has resulted in recovery.

On two occasions the writer has witnessed accidental incision of the bladder during abdominal operations for hysterectomy. In one the incision of the bladder was small, not over an inch in length, while in the other the entire dome of the bladder was amputated. The seriousness of the injury was fully appreciated in both of these cases and careful repair by suturing was made and drainage

by catheter instituted. Both of these patients recovered. Montgomery[13] relates a similar occurrence in a case of fibroid tumor in which it was his misfortune to cut away the entire summit of the bladder. The walls were sutured and the patient recovered. He calls attention to the danger of injury to the bladder during abdominal and pelvic operations and states that during the operation of hysterectomy the bladder is the most likely of the viscera to be injured as it is so closely attached to the anterior wall of the uterus and cervix.

Injury to the bladder may occur during an operation and not be recognized at the time, the extent of the damage coming to light only after considerable time has elapsed and more as a result of impaired circulation or enervation, or degeneration of the area in question, with consequent breaking down of tissue, resulting in urinary fistula.

Surgical injuries may be classified as follows:

1. Injuries during obstetrical operations terminating in slough of the bladder wall with resultant vesico-vaginal fistula, or other dysfunction.

2. Injuries during operations upon the pelvic organs involving actual incision or tearing of the bladder wall, resulting in urinary leakage either through the abdominal wound or through the vagina and possible deposit of encrustation or calculus formation.

3. Injuries during operations for hernia, the bladder being a part of the hernial sac contents and unrecognized.

4. Injuries during intravesical instrumentation.

5. Injuries occurring from overdistention of the bladder.

Injuries to the bladder during obstetrical operations—cesarean section, symphysiotomy and pubotomy—may occur but are usually due to forceps trauma. Pressure necrosis infection and slough are factors of quite as much importance in this group as actual incision or laceration of the bladder.

One of my confrères mentioned having observed accidental incision of the bladder in two cases of cesarean section in a large maternity hospital where he served his interneship.

Perforations of the bladder in attempted abortion have been reported.

One gynecologist reported (personal communication) a perforation of the bladder during curettage. This resulted in a utero-vesical fistula which healed promptly. Martin-Laval[10] reported a tear of the bladder involving three-fourths of its circumference during forceps delivery after pubotomy. Repair of the injury resulted in recovery.

Farman and Thompson[3] report a case of accidental incision of the bladder during hysterectomy. The wound was repaired and the bladder drained by indwelling catheter but the repair failed and a fistula resulted, which required three operations for closure.

They comment as follows: Such injury probably is more frequent in vaginal hysterectomy and may occur in any pelvic or vaginal operation in which the organs are displaced, adhered or friable, as in cancer. In a survey of 290 cases in which operation was performed for cancer of the cervix at Johns Hopkins Hospital Martzloff[11] found vesico-vaginal fistula in sixteen, or 5.5 per cent.

Guiteras[7] says relative to injury to bladder hernia: "I have had a number of cases of inguinal bladder hernia in a large hernia service at the Columbus Hospital and have cut but one bladder."

Concerning hernia of the bladder Keyes[8] says: "The bladder may form part of the contents of any pelvic hernia, abdominal, inguinal crural, perineal, ischiatic or through the foramen ovale. Among twenty-two femoral cystoceles collected by Gibson, sixteen occurred in women, while seventy among his seventy-seven cases of inguinal cystocele occurred in men.

"Lotheissen collected 113 cases of inguinal cystocele in men and only eleven in women. He believes that cystocele occurs in 3 per cent of all inguinal herniæ, although the usual estimate is from 1 to 2 per cent. Inguinal cystocele is extraperitoneal in 70 per cent of cases, paraperitoneal, 'mixed,' 25 per cent, and intraperitoneal in only 5 per cent. As extraperitoneal cystocele is encountered only in direct inguinal hernia, it is in this class of cases that cystocele is to be looked for.

"Cystocele is especially common between the ages of thirty and sixty. Its pathogenesis, depending partly upon the hernial traction, partly upon dilatation of the bladder, has been studied by Lotheissen, Lambert, Cheesman, and Alessandri. The diagnosis is rarely made before operation. The suspected presence of cystocele may be verified by cystography."

Gasparjan[4] collected from the literature fourteen cases of injury to the urinary bladder occurring in operations for hernia.

In eight cases the lesion was recognized at the time of operation. In four cases it was not discovered until after the operation. In the reports of two cases the time of diagnosis was not stated. Only three of the patients were subsequently well. One developed a recurrent abdominal tumor, six suffered from cystitis, and disturbances of micturition, one had a phlegmon in the prevesical space, and three had bladder stones.

Gasparjan states that "whenever an operation for hernia is followed by disturbance of micturition, cystoscopy is indicated. Symptomatic treatment is useless. The relief of symptoms usually requires an operative procedure."

Injury to the bladder during intravesical instrumentation is more common than the literature would indicate. Recently there have been several reports of such injury during cystoscopy and litholopaxy. Practically all of them occurred in bladders impaired by disease. Yet it is conceivable that an otherwise normal bladder may be penetrated when in a state of spasmodic contraction. Arteriosclerosis, tuberculosis, carcinoma, calculus, diverticulum, interstitial or submucous cystitis and hypertrophied musculature with hyper-irritability are the pathological conditions most likely to be associated with contracture of the bladder, and predispose to injury during intravesical instrumentation or over-distention.

Young[19] reported ten cases of traumatism of the bladder which occurred during intravesical instrumentation. Of these cases three were by lithotrite with one death, and five by cystoscope with four deaths, one by rongeur and one by punch operation. Two were intraperitoneal and three were extraperitoneal. Recovery occurred in one extraperitoneal case which was incised and drained. He comments as follows: "The instrumental cases represent the dangers associated with any tearing or pulling maneuvers in the bladder. In the cases where no such thing was done the damage was caused by pushing the instrument in too far, usually in a contracted or otherwise pathological bladder. In no case could the bladder be called normal."

Gottleib[5] reported a case of vesical rupture during lithotrity, the only accident of the kind which occurred in the clinic of Fron-

stein in 212 lithotrities performed in the period from 1900 to 1927. The patient, a man sixty-six years of age and arteriosclerotic, was operated on under spinal anesthesia. All of the debris was not aspirated at once, but the aspiration was repeated twelve days later under spinal anesthesia and 100 c.c. distension. Following the aspiration he had bloody micturition. The abdomen became distended and painful. At operation a rent in the bladder was repaired and the wound drained. The patient recovered.

Rytina[16] reported a case of perforation of the bladder which occurred in the hands of an assistant. The patient laughed while the cystoscope was being introduced and fluid feces escaped from the sheath. The instrument could be felt in the rectum. The patient refused operation. Two weeks later the wound was closed and he had no subsequent trouble.

Ordinarily the bladder is not ruptured from over-distention by irrigating fluid unless it is the seat of extensive lesions which weaken its walls.

Ullman[17] showed experimentally that rupture was more likely to occur in cases of cystitis than in normal bladders. One inflamed bladder burst after an injection of 360 c.c. of fluid, while a normal bladder held as much as 2,070 c.c. before rupture occurred.

Rouvillois and Ferron,[15] in an article on traumatic lesions of the bladder, discuss rupture of the bladder from over-distention. They quote from the observations of other investigators who noted rupture of the bladder at various degrees of distention.

Andrey and Dittel observed rupture variously from 300 to 1,500 c.c. distention; Derneuil, 125 c.c.; Monod, 200 c.c.; Delaunoy, 200 c.c.; Uhlmann, 150 and 250 c.c.; Pousson and Guyon expressed the view that it is prudent to limit injections to 200 c.c.

These authors refer to Rosenstein's observation of a rupture of the bladder from accumulated gas during a Bottini operation.

Rejsek[14] reported a case of rupture of the bladder during cystoradiography. His patient, a vigorous man of sixty-eight, complained of frequency and burning, and hematuria. Calculus of the bladder was suspected. Cystoscopy with 120 c.c. distention disclosed a trabeculated bladder but no stone or adenoma of the prostate. For possible hidden diverticulum or reflux a cystogram was made using 120 c.c. of 30 per cent solution of sodium bro-

mide with 2 per cent alypin. Following the procedure there was intense desire to void which persisted after voiding. The film showed a crescentic shaped shadow above the bladder which was mistaken for a diverticulum. Catheter drainage was instituted but the patient developed weakness, fever, abdominal pain, decreased urine, suprapubic dullness and tumefaction. Operation disclosed infiltration of urine and peritonitis. The rupture was not found. There was no diverticulum. The bladder and prevesical space were drained. The patient died on the twelfth day of pneumonia.

Wilhelm[18] reported a case of rupture of the bladder during cystoscopy under gas oxygen anesthesia, and two additional cases by Ashner and Cohen. While under the anesthetic Wilhelm's patient vomited and had a generalized spastic contraction, raising his buttocks about a foot off the table. A few drops of blood flowed out of the cystoscope. Upon operation a perforation into the space of Retzius was found. On the eighth day omentum appeared through the skin edges and upon investigation a subcutaneous evisceration was found. The intestines were replaced but the patient died on the thirteenth day. At autopsy the perforation was healed. At the site of the evisceration there was a localized fibro-purulent peritonitis. Several localized purulent collections were found around the bladder. There was also an acute hemorrhagic cystitis, tuberculosis of the right kidney, bladder, peritoneum, prostate, seminal vesicles and lungs.

Ashner's[18] patient had been operated on for papillary carcinoma of the bladder by resection with the cautery. Two months later cystoscopy revealed a small calculus but no recurrence of the tumor. An attempt to remove the stone was unsuccessful. Two days later, under gas oxygen anesthesia, another attempt was made to remove the calculus through the cystoscope. While under the anesthetic the patient twitched and the cystoscope seemed to enter a pocket from which no irrigation fluid was obtained. A diagnosis of perforation was made and laparotomy done. Clear, waterly fluid was found in the pelvis, and a slit-like perforation low on the posterior wall of the bladder. The wound was repaired. The bladder was then opened and the calculus removed. The patient recovered.

Cohen's[18] patient during cystoscopy, under local anesthesia, suddenly raised his buttocks off the table. Immediately afterward it was noticed that irrigating fluid flowed out of the rectum. He

complained of severe pain and the cystoscope was withdrawn. A permanent catheter was inserted and constipation induced. In two weeks the injury was healed.

Wilhelm concluded that gas oxygen anesthesia is unsuitable and hazardous for cystoscopy and that cystoscopy should not be undertaken with unruly, uncoöperative patients.

Dossot[2] reported from Legueu's clinic a case of perforation of the bladder by auto-catheterization. The patient, a man of eighty-two years, inserted his catheter with force to pass an obstruction and broke off a portion of the catheter. Six days later he was admitted to the clinic with pain in the hypogastrium and induration of the bladder area. Forty-eight hours later he died. The autopsy showed a purulent peritonitis and a fragment of catheter 12 cm. long through the dome of the bladder into the peritoneal cavity.

Berry[1] reported six cases of injury to the bladder during dilatation of urethral stricture.

Martin[9] reported a case of perforation of the bladder during cystoscopy, under epidural anesthesia, at the level of a small tuberculous ulcer, the only lesion found. This patient was a man forty-one years of age who had hematuria. Tubercle bacilli had been found in the urine. On cystoscopic examination the bladder was found to be of small capacity but could be distended to 60 or 70 c.c. At this point the patient felt pain and the injection was stopped. The next day there was evidence of perivesical infiltration at the space of Retzius. A phlegmon developed and the space of Retzius was opened six days later. Perforation of the bladder was apparent as water injected into the bladder escaped through the incision. At autopsy no other lesion of the bladder could be found. Martin comments that "the danger of rupture of the bladder is especially great when spinal anesthesia is used. Physicians should not attempt to dilate the bladder much beyond its pathological capacity under anesthesia."

Mathe[12] reported a case of fatal embolus due to inflation of the bladder with air. Following the injection of 300 c.c. of air into the bladder preliminary to an operative procedure, the patient went into profound shock, and pulse and respiration ceased. The autopsy showed bubbles of air in the iliac veins, mesenteric vessels, vena cava and renal veins; lungs, liver and right heart con-

tained a coarse froth of air. At the base of the bladder was an adenocarcinoma which had allowed the entry of air into the veins.

The foregoing serves to preface the report of cases of injury to the bladder incident to surgical operations, knowledge of which prompted this presentation.

Case 1.—Mrs. L. P. Vaginal hysterectomy. The surgeon's note of the operation stated that a slight nick in the bladder had occurred which was repaired and a catheter was anchored. For four days the temperature remained between 98° and 99.8° with a pulse around 100. Meanwhile the patient complained of severe pain in the right lower abdomen. On the fifth day her temperature mounted to 103.4° An abscess was drained through the vagina. She died on the sixth day after operation. Autopsy disclosed vesico-vaginal fistula—operative in type; complete destruction of trigone of the bladder; complete blocking of left ureter by suture material producing a hydro-ureter, pyonephrosis and a water-logging of the entire renal tract on this side; acute hemorrhagic nephritis; pelvic peritonitis; obstruction of bowel at the lower ileo-cecal zone; pelvic vaginal fistula.

Case 2.—Mrs. A. C., aged forty. During hysterectomy for fibroid uterus the bladder was perforated; the perforation being about 1 inch long. The wound in the bladder was sutured, drainage placed in the pelvis, and a catheter anchored. On the ninth day the patient developed a chill with high fever and rapid, weak pulse and died. No autopsy was permitted.

Case 3.—Mrs. E. W., aged thirty-six, following hysterectomy had leakage of urine through the vagina. Cystoscopy disclosed a vesico-vaginal fistula. She was successfully operated on for repair of the fistula.

Case 4.—Mrs. D. H., aged twenty-six, ran a septic temperature after pan-hysterectomy. On the tenth day a large amount of pus drained from the wound. Upon dismissal from the hospital her wound was not quite healed but was free from drainage. She was re-admitted six months later because of incontinence of urine which developed just after dismissal from the hospital following her former surgery. Cystoscopy showed a vesico-vaginal fistula. She was operated on for repair of the fistula.

Case 5.—Mrs. R. N. B. developed a vesico-vaginal fistula after hysterectomy for fibroid uterus. Several attempts by her surgeon to repair it failed because of infection and encrustations about the fistula. There was a reduction in the size of the opening after the attempts at closure, and final closure followed cauterization of the tract by fulguration.

Case 6.—Mrs. M. T., aged fifty. A discharge of urine through the vagina was observed three days after hysterectomy for cancer of the uterus. Injury to the bladder was not recognized by the surgeon during the operation. Cystoscopy showed a vesico-vaginal opening 2 cm. in diameter high up on the vesico-vaginal septum. It was successfully repaired. The patient died two years and eight months later of carcinoma.

Case 7.—Mrs. M. O. D., aged thirty-six, had leakage of urine through the vagina following hysterectomy. Cystoscopic examination showed an opening into the vagina. An operation for repair of the fistula was apparently successful but it recurred nine months later. Cystoscopic examination revealed a lime encrusted silk suture in the margin of the fistula. This was removed. The opening at present is about 1 cm. in diameter.

Case 8.—Mrs. E. P. was admitted to the hospital with a diagnosis of early pregnancy and an inguinolabial tumor, probably a hernia. At operation the surgeon found a hernial sac which was dissected out and ligated. The labial tumor was still present. As it contained fluid it was mistaken for a hydrocele of the canal of Nuck. An attempt was made to resect it and the wound closed. At the first catheterization bloody urine was obtained. The wound was opened and urine escaped. Drainage was inserted but the patient became septic and died on the fifteenth day. The autopsy disclosed that the entire bladder mucosa, except the trigone, had been excised at the operation.

SUMMARY

Tabulating the cases from the literature and the author's eight compiled cases, twenty-three sources in all, there were seventy-six instances of injury to the bladder during surgical operations. There were fourteen known deaths, and in sixty-two the outcome was not stated.

Operations in which accidents occurred:

Hysterectomy	27
Other abdominal operations	4
Cesarean section	2
Pubotomy and forceps delivery	1
Curettage	1
Hernia	16
Sounding	6
Catheterization	1
Intravesical instrumentation, lithotrite, cystoscope, rongeur and punch	15
Overdistention: fluids 2; air 1; gas 1 (from Bottini operation)	3

CONCLUSION

While these data show that accidental injuries to the bladder occur more frequently during hysterectomy and herniotomy, urologists are particularly interested in the frequency of injury during intravesical instrumentation, which comes next in order of frequency.

The occurrence of serious injury in several cases was due to overdistention of the bladder during anesthesia. This should suggest caution in the use of spinal and general anesthesia for cystoscopy and the avoidance of overdistention in any case but especially the pathological bladder.

For the general surgeon the knowledge that accidental injuries to the bladder occur most often when that viscus is distended should remind him to catheterize his patient before any pelvic or abdominal operation. This applies also to the woman in labor whose bladder may be spared injury by catheterization.

Routine cystography in all cases of large herniæ should settle any doubt as to the presence of cystocele.

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RESECTION OF THE PRESACRAL NERVE IN THE PAINFUL BLADDER OF INTERSTITIAL CYSTITIS

WILLIAM C. QUINBY, M.D.
Boston, Massachusetts

Of recent years gratifying progress has been made in our knowledge of the phenomenon of pain, and corresponding increase in our ability to control it has been forthcoming. One need only mention the work of Foerster and of Leriche in this regard; the one attacking those varieties of painful sensations carried by the somatic nerves entering the spino-thalmic tract of the cord, the other interesting himself in the sympathetic nerves accompanying the blood vessels.

Pain may be relieved, of course, in one of three ways: either its cause in some peripheral area of the body may be healed or removed; or, if it be of such transient nature as to warrant, the cerebral receptor areas may be temporarily thrown out of function by the use of a hypnotic drug; or, lastly, the pathway by which the painful stimulus reaches the sensorium may be broken by a surgical procedure wherever such conducting pathway is most accessible.

To determine the pathway by which painful sensations of visceral origin reach the brain or spinal cord has necessitated much increase in the physiological knowledge of the sympathetic nervous system. The earlier observations of the English physiologists, Langley and Anderson, laid the basis for much of our knowledge of the nerve supply of the viscera in various laboratory animals, especially the cat and dog. Unfortunately these results are not applicable in their entirety to man.

As concerns the urinary bladder the nervous control is quite complicated and has been the subject of many investigations, noteworthy among which are those of Dennig and of Barrington. In summary: the bladder is controlled by three separate nerves, each of them paired. They are (1) the hypogastrics (sympathetic), (2) the pelvics (parasympathetic), and (3) the pudics (somatic). All of these nerves carry sensory as well as motor fibers, and under physiological conditions control the act of micturition.

Since we have no knowledge of the presence of any pain fibers as such nor any especial nervous end-organs in the bladder, it is doubtless true that when pain is felt this is due to increase of the stimuli which under normal circumstances call forth micturition. Therefore, the perception of pain in the bladder may be conducted centrally along any or all of the three varieties of nerves mentioned above supplying this organ. The older suggestion of Lennander that visceral pain (intestinal especially) is due to traction on the peritoneum certainly does not apply to the urinary bladder, for this organ is only partly covered by peritoneum, and also it is well known clinically that the most acutely sensitive portion of the bladder is its so-called fixed portion; that is, that portion of the organ which does not distend and which is represented by the trigonal and sphincter regions at its outlet. Bladder pain, therefore, is probably caused by undue contraction or undue dilatation in the presence of alterations which have previously been brought about in the nerve endings in its wall, usually the result of inflammation. Pain, therefore, represents merely increase in the intensity and duration of the stimulus to urinate.

It follows from the above that hopes of interrupting the sensory pathway from the bladder by section of any of its nerves while at the same time its motor power is retained may be vain even though the anatomical approach to any or all of the various nerves is a surgical possibility. But it is known that of the three varieties of nerves to the bladder those of greatest importance in the maintenance of normal function are the pelvic and pudic nerves. The hypogastric nerve, as far as is known, serves as a motor nerve to the internal sphincter and trigone and also carries inhibitory impulses to the detrusor. As mentioned, it also carries some of the centripetal stimuli from the organ. Loss of this nerve alone does not cause serious crippling of the bladder from a functional point of view. Whether or not division of the hypogastric nerves will so reduce the perception of pain from the bladder as either to abolish it or to make it more tolerable can only be determined by the results of such division performed on man.

THE HYPOGASTRIC PLEXUS AND THE "PRESACRAL NERVE"

That there is considerable variation in the anatomical arrangement of the sympathetic nerve fibers going to the pelvis is evident,

for none of the older anatomical works gives any very clear cut illustrations of these structures. The results of more exact observations more recently made, however, show that the hypogastrics arise as a result of the union of fibers from the main lateral sympathetic chains on each side of the aorta. At its bifurcation or just below, these fibers either unite into a single nerve lying in front of the first sacral vertebra, and, therefore, are called the *presacral nerve,* or in other instances no single nerve is formed but there is found instead a plexus made up of several such nerves having, however, the same origin in the main lateral sympathetic chains. Such nerve trunks, either the presacral as such, or a plexus, carry the hypogastric nerves to the bladder. It is evident that the surgical approach to this region is not difficult, needing as it does merely a careful dissection of the retroperitoneal tissues in the region of the bifurcation of the aorta and just below. Here the nerves will be found either as a definite presacral trunk (occurring in only about one-fifth of the cases), or as a plexus. A sufficient area may then be resected so as to prevent regeneration.

The attempts to control pain in the pelvic distribution of these nerves originated at the Lyonnais school of surgeons, especially at the hands of Leriche and of Cotte. Resections were made in the earlier instances to relieve obstinate dysmenorrhea or the pain of uterine cancer. Later the operation was extended to include painful cystitis, often that resulting from tuberculosis of the bladder. Though the literature contains records of about 200 operations of this sort, only a minor number have been carried out to relieve bladder pain—as such—and the results of these are rather hard to evaluate from the published reports.

Recently, Learmonth, working at the Mayo Clinic, has engaged in an exhaustive study of the sympathetic supply of the lower bowel and pelvis and has resected the hypogastrics or presacral nerve in a number of patients complaining of intractable cystitis.

It must be confessed that when one considers that the urinary bladder may send afferent impulses through three different nervous pathways it would seem somewhat doubtful that removal of one only—and that a rather minor one—could bring sufficient relief to be of significance. From the published reports there seems to be no doubt that the resection of the hypogastrics has a marked effect on the vasomotor mechanism of the pelvis, for it is said that

menstruation quite regularly follows the operation within two or three days. This, of course, is analogous to those vasodilator changes which follow peri-arterial sympathectomy.

Numerous cases of intractable pain in the bladder exist, for the relief of which many remedies have been tried in vain. It is entirely justifiable to attempt resection of the presacral nerve for such patients even though our present knowledge regarding the results of such an operation is still in the formative stage. The operation is without undue risk and may possibly be of help.

REPORT OF A CASE

Intractable cystalgia due to interstitial fibrosis of the bladder.

B. W., a woman of fifty-six, entered the hospital July 15, 1927.

Onset of illness began in May, 1926, with sudden pain and swelling of knee. These symptoms subsided, but before this had occurred signs of severe bladder infection began, characterized by frequency and ardor. Two months later these had increased and there had been also a period of hematuria. Shortly after there developed a steady, moderately severe pain in the bladder. Since the onset there have been slight remissions of symptoms followed by acute exacerbations.

On examination there were evidences of interstitial cystitis seen by cystoscope. The urine showed Bacillus coli on culture. Bladder capacity was 80-100 cubic centimeters. Hydraulic distention of the bladder was carried out.

In September, November, and December this was repeated. For a short time after each distention there was almost complete relief, but then frequency, burning and nocturia returned to cause almost as much discomfort as at the onset of the illness.

In January, 1928, a pelvic mass associated with the uterus was found. A panhysterectomy was done, together with the resection of a fibroma of one ovary. It was hoped that this might relieve pressure on the bladder. Irrigations and hydraulic distention followed the operation. All bladder discomfort was relieved for several months, but again the symptoms returned.

On May 3, 1928, a suprapubic cystotomy was done. Direct observation of the bladder revealed two small, ulcerated, bleeding areas, one of which was excised and the other fulgurated. The patient left the hospital after three weeks feeling greatly relieved, but after several months the symptoms again returned.

On May 5, 1929, the patient re-entered the hospital with the additional complaint of gastro-intestinal upsets with fullness after eating, gas, distention and occasional diarrhea. X-rays of the gastro-intestinal tract were negative. A vesico-vaginal fistula was made at this time to put the bladder at rest. Cystoscopy three weeks later showed that the ulcerated areas had nearly healed. The patient felt much better and the only discomfort was in keeping herself dry.

On February 2, 1930, the patient returned, stating that her general condition and "nervous mechanism" had been much upset since the previous admission. She complained of headache, distention, gas, flatus, and anorexia. She felt "poorly" in general and wished the fistula repaired. Gastro-intestinal studies were negative. Blood pressure was 156/80 to 180/95. It was felt that the symptoms might be due to hypertension and that her cardio-

vascular system was not up to the normal level. It was decided to discharge the patient to her local doctor until her general condition warranted repair of the fistula.

On October 26, 1930, the patient entered the hospital for closure of the fistula. She felt unusually well at this time, having gained 18 pounds in weight. She gave a history, however, of an attack of jaundice three months before with vomiting of green material, and clay-colored stools. The attack lasted one week and was accompanied by epigastric pain which was relieved by belching of gas. The blood pressure was 155/80. The vesicovaginal fistula was repaired and the patient discharged on the eleventh postoperative day with instructions to drink water and attempt to hold the urine as long as possible. At the time of discharge she could hold approximately 1 ounce.

The patient again returned to the hospital, March 30, 1931, stating that after leaving the hospital four months before she had followed instructions and at the end of one month was able to hold approximately 7 ounces of urine in her bladder. Then, two months ago, her old symptoms recurred, first the frequency and then burning and pain on micturition. In a short time they were as bad as ever, with frequency ten to fifteen times a day and nocturia three or four times. This had persisted up to the time of admission. The urine had appeared clear throughout. The patient believed that her bladder capacity was at this time only about 2 ounces. In addition her gastro-intestinal symptoms had been more troublesome. She was constipated and required petrolagar each night until three months ago, when she again began to feel bloated and had generalized lower abdominal pain. Five weeks before her admission she had an attack of "intestinal flu" characterized by an almost continuous diarrhea for forty-eight hours, and much mucus and blood in the stools. This caused her hemorrhoids to be very painful and they continued to trouble her. She continued to have three or four stools per day since this attack, and also was passing much mucus. Occasionally she passed gross blood, but none had been noted during the week before admission.

As the patient had a long history of bladder difficulty due to interstitial fibrosis for which no therapy had been of avail, it seemed wise to do a sympathectomy in the hope of relieving sensation from the bladder. Therefore, on April 4, 1931, under avertin anesthesia a hypogastric sympathectomy was performed. With the patient in the high Trendelenburg position, the intestines were walled back by gauze pads and the sigmoid lifted out of the pelvis and held in a convenient position by a single stitch to the edge of the abdominal wound. A single small adhesion subsequent to previous operation was divided. The anterior surface of the promontory of the sacrum was thus exposed and a transverse incision made through the peritoneum over this area. By careful dissection all the tissues beneath the peritoneum and in front of the great vessels were dissected free and reflected upward. On each side of the common iliac artery the main sympathetic trunk was isolated and a portion about 3 cm. long excised. The nerves making up the hypogastric plexus could not be identified as a single nerve, so that all nervous and lymphatic tissue was removed down to the surface of the great vessels. This produced a triangular mass of tissue, with the base below and apex above, toward the bifurcation of the aorta. After transection of this mass below it was still further dissected upward and eventually removed at about the level of the bifurcation. The iliac arteries as well as veins were entirely freed from nervous tissue as far as could be seen without definitely dislocating these vessels. In only one small spot was any venous bleeding encountered and this was controlled by a bit of superimposed muscle. The wound being dry, the peritoneum was closed by a few interrupted stitches and the abdomen closed in layers in the usual manner. X-ray studies of the gall bladder having shown

cholelithiasis, the gall bladder was then removed through a separate abdominal incision.

The patient was discharged April 23, 1931, her nineteenth postoperative day. She was able to go thirty to forty-five minutes without the use of a urinal. She had had no discomfort from gradual distention of her bladder, which had a capacity of 30 to 50 c.c. She was told to wait as long as possible between the acts of micturition in the hope of stretching the bladder. She was having no trouble from gas or belching, her appetite was good, her bowels had been moving with a fair degree of satisfaction with moderate catharsis. The patient stated that she felt better than for some time. Though the frequent calls to urinate were still present, she felt sure that the degree of pain in her bladder had been much diminished.

The patient was seen six months after operation. The bladder pains had remained much diminished and the patient's general health and morale were definitely better. The very small bladder capacity, however, still persisted, restricting many activities by day and giving much trouble at night. Examination showed the urine to be clear and free from infection. The bladder capacity was only 40 to 60 c.c. and attempts to distend it caused much discomfort. By cystoscope three areas of ecchymosis and fibrosis were seen in the vault.

As a result of section of the hypogastrics in this case there seems no doubt that some of the pain from the bladder has been relieved. No effect has been evident on the power of the bladder to hold urine.

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LEIOMYOMA OF THE BLADDER

WITH REPORT OF A CASE AND A REVIEW OF THE LITERATURE

HERMAN L. KRETSCHMER, M.D.

From the Presbyterian Hospital of Chicago and Rush Medical College of The University of Chicago, Chicago, Illinois

Epithelial tumors of the bladder, namely, benign papillomata, and the various types of carcinomata, form the common group. On the other hand, mesothelial tumors, both benign and malignant, are rare, and form a very small percentage of bladder tumors.

Because of the rarity of these tumors, it seems justifiable to place the following case on record and to review the literature.

CASE REPORT

P. S., female, aged nineteen years, was admitted to the Presbyterian Hospital, September 16, 1929, referred by Dr. Winograd.

Previous history was negative.

About three weeks before admission to the hospital, without any warning, the patient began having hematuria which was associated with pain on urination. The pain was of a burning type and lasted only during the act of urination, after which the patient was perfectly comfortable, but the urine was tinged with blood and some clots were passed. She entered another hospital for examination and was given a blood transfusion for anemia but gradually grew worse. Upon entering the Presbyterian Hospital there was profuse bleeding from the bladder.

Physical examination revealed a well-developed and well-nourished, though very anemic, girl, suffering from paroxysms of pain.

Head examination was negative. Mucous membrane of mouth was pale. Neck, lungs and heart were normal. There was tenderness over the suprapubic region in the abdomen. Reflexes were normal.

Blood examination gave red cells, 3,500,000; leukocytes, 12,500; hemoglobin, 45 per cent. Blood pressure was—systolic, 120; diastolic, 65.

Blood chemical examination showed urea nitrogen, 10.8; uric acid, 4.7; creatinin, 1.2; non-protein nitrogen, 22.6. Blood Wassermann test was negative. Urinalysis showed albumin 0; blood +; leukocytes +. Roentgen-ray examination was negative.

Cystoscopic examination under ethylene and ether anesthesia revealed a necrotic tumor, about the size of a peach, in the dome of the

bladder. Urine obtained at this examination showed 8,800 leukocytes per cubic millimeter and staphylococcus albus upon culture.

Cystogram (Fig. 1) showed a practically normal sized bladder, well filled except for a filling defect on each outer aspect, with a heavier central pear-shaped density which is sharply outlined against the lessened density of well brought out rugæ in the areas of the filling defects. These rugæ are visible in the outer one-third of the left side of the bladder, and to within 1.5 cm. of the outer margin on the right

Fig. 1. Cystogram showing oval, slightly translucent area in left half of bladder, indicating size and shape of mass. Adjacent to this the bladder outline has lost its usual regularity.

and upper aspects. The base of the bladder is also filled and is seen as a rounded prejection at the lower central margin of the cystogram.

Diagnosis was tumor of the bladder and operation advised.

Operation was performed under ethylene anesthesia, September 20, 1929, consisting of a suprapubic cystotomy with a very wide resection of the bladder wall. Recovery was uneventful. The patient was discharged from the hospital, November 11, 1929.

Gross and microscopic description of the specimen (Dr. E. R. Le Count).—The piece of bladder wall removed with the tumor was 54

mm. long by 23 to 29 wide. The pedicle of the tumor was about 10 mm. in diameter and fairly round, but so short that the tumor rested against the lining of the bladder. The longest dimension of the tumor, parallel with the lining of the bladder, was 62 mm.; the width, which also rested against tthe lining was 35 mm. Measured with the pedicle the tumor projected 33 mm. into the cavity of the bladder.

The surface was rough and finely granular, apparently superficially

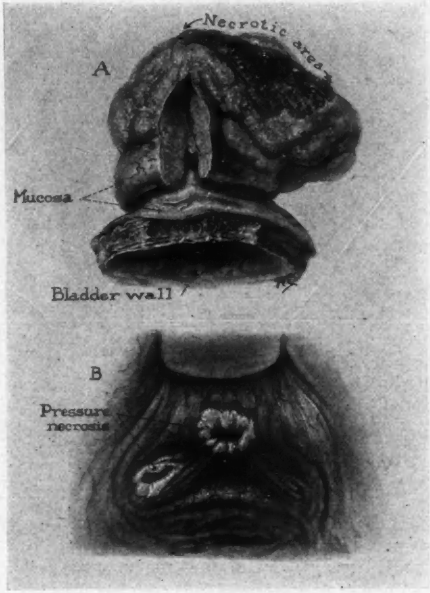

Fig. 2. *(A)* Note the large area of superficial necrosis on the upper surface of the tumor. *(B)* Pressure necrosis around the internal urethral orifice and left ureteral orifice, due to the tumor.

necrotic. This necrosis was only 1 to 2 mm. thick.. Beneath this zone the tumor was uniformly compact except for a few small brownish regions of greater vascularity or hemorrhage. There was a fine marking on surfaces made by cutting the growth due to the radiation of the fibers from the pedicle (Fig. 3). There was no noteworthy change of the attached bladder wall.

Histology.—The tumor cells were large, smooth muscle cells, 70 to 100 μ long with nuclei 14 to 19 μ long (Fig. 4). The nuclei were rounded at the ends and quite clear except for 8 to 20 coarse particles of chromatin and, for the most part, a single large nucleus staining a deep pink. A few nuclei had two nucleoli. The nuclear membranes and chromatin were almost black from hematoxylin. A few nuclei were in mitosis.

The cytoplasm stained deeply with eosin, was faintly marked longitudinally and the tapering ends of the cells were slightly frayed. Al-

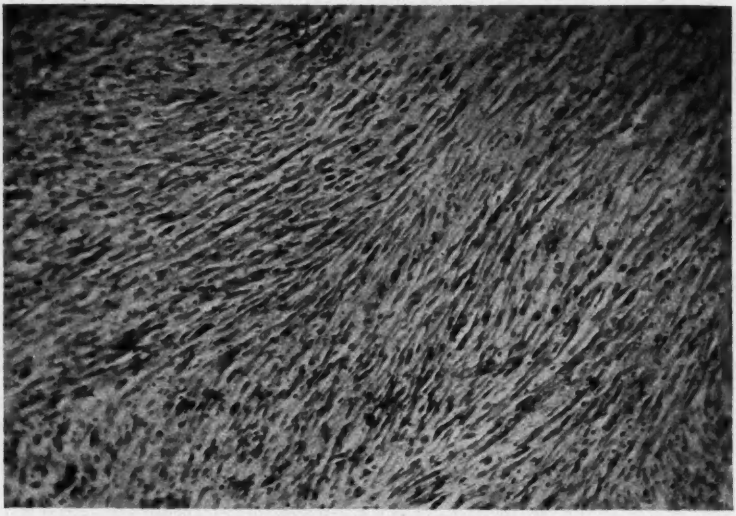

Fig. 3. This parallel arrangement of the smooth muscle cells radiating from the pedicle to the periphery of the tumor was the main feature of surfaces made by splitting the tumor in halves.

though this description fitted the great majority of the tumor cells, there were some more nearly round, 15 to 35 mm. in diameter with blunt rounded ends. In such cells the nuclei were usually eccentric. Some of these were undoubtedly cross-sections of muscle cells since they occurred in bundles. Others lay in bands, "mavericks," where all the other cells were long spindles. Some places in the growth were slightly edematous, but these were not sharply demarcated and the edema was not extreme anywhere. The vessels were few and small with walls made of apparently nothing but tumor cells. The tumor cells were suspended in a basketry of delicate collagen fibrils, at no

place gathered in bands wider than the tumor cells, and even such bands were few and far apart.

REVIEW OF THE LITERATURE

As noted by Stevens, it has generally been the custom in the past to review all the benign mesothelial tumors of the bladder, including pure fibromata, myxomata, fibromyomata, lipomata and leiomyomata in a single group. In this paper I shall limit my dis-

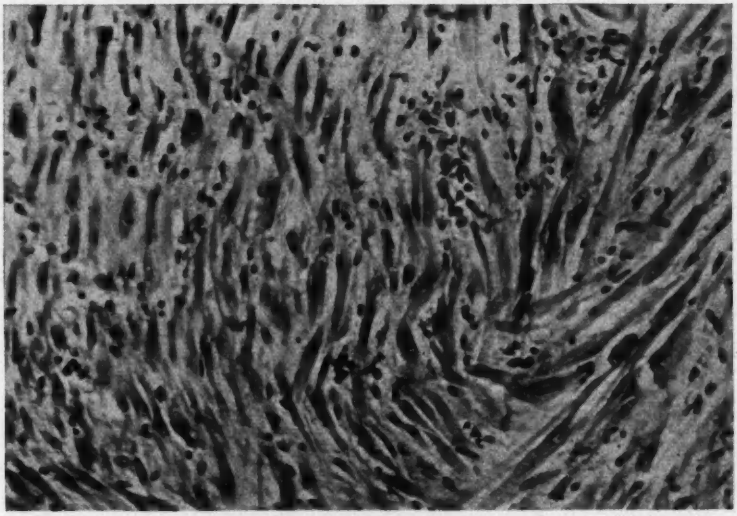

Fig. 4. From a field in a section not far from the necrotic surface, consequently a few leukocytes are present. With muscle fibers so heavy with cytoplasm, phosphotungstic acid hematoxylin was used to demonstrate absence of cross striation and decide the growth was not a rhabdomyoma.

cussion to leiomyomata, and shall select from the literature only such vesical tumors as are composed of smooth muscle, or of this element plus fibrous connective tissue in varying amounts (fibromyomata).

I am including the tumor reported by Kidd and Turnbull as an "angiomyoma," which consisted of smooth muscle and dilated blood vessels.

No.	Author	Age	Sex	Complaints	Duration	Treatment
1	Faye (1871)	41	F	Frequency, dysuria, abdominal tumor	10 years	
2	Volkmann (1876)	54	M	Hematuria, dysuria, palpable tumor	7 months	Operative removal
3	Belfield (1881) (1)	50	F			
4	Belfield (1881) (2)	74	M			
5	Socin (1883)	51	M			
6	Tassi (1886)	25	F	Hematuria, dysuria, periodical complete retention	Few months	Operative removal
7	Gibbons and Parker (1887)	18	F	Occasional hematuria, cystitis, incontinence	5 months	Operative removal
8	Pollailon and LeGrand (1888)	50	F	Frequency, pain, heaviness in pelvis, enlargement of abdomen	18 months	Operative removal
9	Nicolich (1889)	47	M	Hematuria, vesical tenesmus		Operative removal
10	Naumann (1890)	74	M	Hematuria (occasional at first, later continuous)	Many years	Operative removal
11	Warholm (1893)	28	F	Pain, incontinence		Operative removal
12	Wallace (1893)	28	M	Hematuria, suprapubic pain		Operative removal
13	Karstrom (quoted by Cassanello (1895)	50	F	Hematuria		Operative removal
14	Terrier and Hartmann (1895)	60	F	Hematuria, cystitis	1 month	Operative removal
15	Gerard Marchant (quoted by Terrier and Hartmann) (1895)	36	M	Hematuria, dysuria, frequency		
16	Verhoogen (1895) (1)					
17	Verhoogen (1895) (2)	23	M	Pain, region of anus, radiating to abdomen. Imperative desire		Operative removal
18	Riegel (1899)	20	F			
19	Ramsay (1900)	38	F	Hematuria, dysuria, tenesmus		Operative removal
20	Freyer (1902-1903)	24	F	Hematuria, tumor		Operative removal
21	Cassanello (1903)	52	M	Frequency, abdominal tumor	7 years	Operative removal
22	Kraske (1904)					Partial extirpation

HE BLADDER

Histological Report	Outcome	Remarks
romyoma		Tumor necessitated operative termination of pregnancy. Patient died. Autopsy revealed tumor size of adult head. Subserous.
oma	Death 4th day	Tumor (submucous) size of an egg, attached to dome of pedicle. Death due to postoperative peritonitis.
oma		Discovered at autopsy in woman dead of pneumonia. Subserous, size of walnut, at left side of base. Anterior surface of uterus showed subserous myoma size of bean.
oma		Discovered at autopsy. Death due to pneumonia. There was a left sided uretero-hydronephrosis due to tumor blocking ureteral orifice. Tumor measured 7 mm. in diameter.
oma		Discovered at autopsy. Pediculated tumor caused bilateral infected uretero-hydronephrosis.
romyoma	Recovery	Tumor present at same time with calculus size of hen's egg. Tumor size of walnut, bulged into cavity at right of trigone.
oma	Recovery	Tumor size of pigeon's egg, pediculated, on the trigone.
oma	Died 1 month later	Subserous, pediculated, attached near insertion of urachus.
romyoma	Died 1 month later	Size of a plum. Pediculated. Right side of trigone.
romyoma	Recovery after three months	Posterior bladder wall and trigone, submucous. Size of fist.
iomyoma	Recovery	Subserous, attached to anterior wall. Size of walnut.
romyoma		Sessile, size of walnut, submucous. Surface covered by calcareous incrustations.
romyoma	Recovery	Size of egg, submucous. Posterior wall of bladder.
oma	Recurred twice. Death at third operation	Size of small egg, sessile, on trigone. Surface incrusted with calcareous deposits. In spite of recurrences, showed itself always a myoma with no malignant changes.
oma	Recovery	Pediculated, inserted at anterior and left lateral wall, 6 cm. in length. Died of extraneous condition 6 months later, at which time there was no recurrence.
oma		Reported as small intramural myoma discovered at autopsy.
romyoma	Death 1 day following operation	There were dense adhesions to intestines, abdominal, pelvic, and anterior bladder walls. Tumor was subperitoneal, pediculated, attached to posterior bladder wall.
oma	Death (uremic symptoms)	Autopsy revealed two vesical myomata, one subserous, the other a large submucous tumor occupying most of the bladder, obstructing ureteral orifices and causing a bilateral hydronephrosis.
oma	Recovery (postoperative)	Death short time later with no recurrences. Tumor situated at left of base.
iomyoma	Good	Tumor obstructed vulval outlet by bulging anterior vaginal wall. Easily reducible. Sessile, situated on trigone between openings of urethra and left ureter.
oma	Recovery	Arose from anterior wall at junction with dome. Weighed 2 kgr. Two small fibroid masses in anterior wall. Tumor was subserous.
oma	Recovery	Growth was diffuse in posterior bladder wall. Impossible to remove it completely. Patient living and well at end of six years.

23	Pashkis (1908)	Aged	F			
24	Bohme (1909) (quoted by Judd)					Operative removal
25	Kouzenetzki (1909)					Operative removal
26	Levings (1909)	35	F	Frequency, dragging sensation in bladder region, abdominal tumor	1 year	Incomplete operative moval
27	Bouchard (1910)	46	F	Abdominal tumor		Operative removal
28	Heitz-Boyer and Dore (1910)	41	F	Hematuria, tumor palpable by vagina, cystitis (5 years)	1 month	Operative removal
29	Figuroff (quoted by Heitz-Boyer and Dore)	37	F	Frequency, painful urination	6 months	Operative removal
30	Gotzel (1912)		M	Hematuria, frequency, dysuria, retention	1 month	Operative removal
31	Sinclair (1913)	44	F	Hematuria, dysuria, retention	3 months	Operative removal
32	Kelly and Burnam (1914)					Operative removal
33	Judd (1914) (1)	61	M	Hematuria, frequency (occasional)	9 years	Operative removal
34	Judd (2)	50	M	Occasional hematuria Pain and obstruction	4 years 1 month	Operative removal
35	Gronberger (1914)	44	F	Dysuria, pain, cystitis	7 years	Operative removal
36	Zukerkandl (1914)	35	M	Dysuria, frequency	About 6 years	Operative removal
37	McNally (1921)	54	M	Frequency	2 years	Operative removal
38	Bovin (1921)	34	F	Painful urination		Operative removal
39	Scholl (1922)	50	M	Painless hematuria	years	Operative removal
40	Kidd and Turnbull (1923)	29	M	Recurring attacks acute retention	2 years	Operative removal
41	Heinsius (1923)	35	F			Operative removal
42	Kostjurin (1925)	44	M	Frequency	4 months	Operative removal
43	Saturski (1926)	33	F	Hematuria, dysuria, cystitis, retention, tumor protruding into vagina	1 month	Pedicle cut with cautery through dilated urethra. Patient expelled tumor after digital exploration of bladder
44	Stevens (1928)	59	M	Hematuria, frequency	Several months	Operative removal
45	Chamberlain (1929)	79	M	Intermittent hematuria	1½ years	Sac containing tumor excised
46	Wershub (1929)	42	F	Hematuria, dysuria, frequency	About 2 years	Operative removal
47	De Berne-Lagarde (1929)	42	F	Increasingly difficult urination; Complete retention	7 years 2 months	Operative removal
48	Kretschmer (1931)	19	F	Hematuria, pain on urination	3 weeks	Operative removal

E BLADDER—*Continued*

oma		Discovered at autopsy. Size of pea. Had caused no symptoms.
omyoma	Good	
omyoma		Weighed over 9 kgr., 81 cm. in greatest diameter. Subserous, attached to posterior superior wall.
fibroma	Good	Diagnosed clinically as uterine fibroid. Size adult head. Grew from posterior wall, pushing broad ligament anteriorly and upward, extending into abdomen.
oma	Died, embolus (postoperative)	Diagnosed clinically as uterine fibroid. On posterior bladder wall, weighed 2,850 grams.
omyoma	Recovery	Submucous and sessile. Weight 90 grams. On posterior superior wall. There were a number of smaller tumors of same nature present.
omyoma	Good	Growth interstitial, right posterior quadrant, size of walnut.
myomata (multiple)	Recovery	Four tumors, the largest of which was the size of an egg, observed by cystoscope and diagnosed at that time as myomata due to intact mucosa.
omyoma	Recovery	Sprang from trigone and filled bladder.
oma	Death due to infection	At dome of bladder, filling it. Caused prolapse of anterior vaginal wall and engaged in urethra.
omyoma	Good	Near urethral orifice. Weight 40 grams.
omyoma	Good	Pediculated, vertex. Weight 230 grams.
oleiomyoma	Good	Size of hen's egg. Papillary excrescences of overlying mucosa. Pedicle inserted 2 cm. in front and to left of urethral orifice.
oma	Good	Size of goose egg in anterior wall.
oma	Good	Subserous, weight 1½ pounds.
oma	Recovery	Posterior wall near urethral orifice, submucous.
omyoma	Good	Living and well after eight years. Attached to anterior wall above sphincter of urethra, 9 cm. in diameter.
iomyoma	Good	Pediculated, size of date, raspberry appearance. Anterior wall near internal meatus.
oma		Size of child's head. Subserous. Adhesions to sigmoid and appendix.
omyoma	Recovery	Size of cherry, sessile, at bladder neck, submucous.
omyoma	Recovery	Size of an egg, pediculated.
omyoma	Good	Short thick pedicle, 3 cm. in diameter.
omyoma	Good	Occurred in wall of a small diverticulum. A few centimeters in diameter.
omyoma	Recovery	Patient dated onset of symptoms to fall with trauma to left side of abdomen. Pediculated, 2 cm. in diameter.
oma	Recovery	Attached posterior part of neck to left of median line. Became engaged in urethral orifice.
omyoma	Recovery	Size of goose egg, pedunculated, on superior lateral wall of bladder cavity.

Zuckerkandl, in 1905, stated that the first bladder myoma was reported by Virchow, and another by Knox in the *Medical Times and Gazette* of 1862. Zuckerkandl adds that at that time there were twenty such cases in the literature.

Watson, in 1905, presented a treatise on the operative treatment of bladder tumors and, with it, included a table containing the writer's name, the method of treatment, and the outcome in twenty cases of benign bladder tumors which he had collected from published reports.

Heitz-Boyer and Dore, in 1910, published a paper on the subject of smooth muscle tumors of the bladder in which they collected thirty-two cases, twenty-five of which (including their own case) were simple myomata, and seven in the process of malignant degeneration.

Koll, in 1923, presented a paper entitled "Fibroids of the Urinary Bladder." He included under the term "fibroid," fibromata and myxofibromata. His own case was a fibroma. Thirty-eight cases were gathered from the literature and were grouped as twenty-two myomata, two myofibromata, eight fibromyomata, two leiomyomata, one myxofibroma, and three fibromata.

De Berne-Lagarde, in 1929, published a very thorough treatise on the subject of leiomyomata of the bladder, together with an extensive review of the reported cases. He gathered from the literature thirty-five well established cases and added one of his own, thus making a total of thirty-six.

The present study is based on thirty-six cases mentioned by De Berne-Lagarde, together with eleven others found in the literature, and the case reported in this paper. Thus the total number of well-authenticated cases of vesical myomata in the literature amounts to forty-eight.

Cases have been omitted from this review in which there appears to be any doubt about the histological diagnosis. For this reason I do not include the cases of Gussenbauer, the microscopic description of which suggests the possibility of their being sarcomata.

FREQUENCY

That smooth muscle tumors (or any tumors of mesothelial origin) are extremely rare is well demonstrated by the fact that numerous articles appear in the literature dealing with various aspects

of bladder tumors and their treatment, which make no mention of any but the epithelial variety.

Although figures vary somewhat, it is generally stated that 90 per cent of all bladder tumors are of epithelial origin, while the remaining 10 per cent are mesothelial or embryonic in origin. There is a wide difference in the numbers of vesical myomata which have been encountered by various authors in the series of bladder tumors which they have studied. Watson found ten myomata in 653 vesical tumors. Motz reports that three such tumors occurred in his series of eighty-seven tumors of the bladder. De Berne-Lagarde states that Nitze (quoted by Weinrich) observed 399 cases of vesical tumor, none of which was a myoma.

Scholl studied a series of 262 bladder tumors which were operated on at the Mayo Clinic during the period from January, 1910. to January, 1920, and of this number, one was a fibromyoma. Judd, in 1914, reported two cases of fibromyomata which occurred in a series of 164 cases.

Scott and McKay found no myomata in a series of 622 bladder neoplasms; MacKenzie found none in a series of 500 cases.

ETIOLOGY

The theory has been advanced that these tumors are of an embryonic origin, developing, according to Verhoogen, from a partially atrophied Müllerian body; from the urachus according to Pilliet and Dupuy (quoted by Heitz-Boyer and Dore); from supernumerary ureters according to Riegal (quoted by Heitz-Boyer and Dore). Hegal (quoted by Koll) suggests that vesical myomata are developed from a hydatid of Morgagni, or the lower layer of the utricle. Heitz-Boyer and Dore and later De Berne-Lagarde assert that these theories of an embryonic origin have this in their favor that they are simple, and on account of their simplicity should be accepted.

According to Blum, myomata develop from the hypertrophied bladder musculature, secondary to chronic inflammatory changes. Claisse (quoted by Heitz-Boyer and Dore) is of the opinion that uterine fibromyomata are due to perivascular inflammation caused by infectious agents acting on the walls of the uterine vessels and that the same theory is applicable to tumors of the urinary bladder.

The association of calculi with vesical myomata is so rare that

they should be excluded as etiological factors. A coexisting cystitis is found occasionally, but its presence should be interpreted as secondary to the pressure of the tumor and not as a factor in the production of the tumor.

AGE

Heitz-Boyer and Dore found that myomata of the bladder have no special age predilection. In a series of twenty-seven myomata they found the ages to range from twelve to seventy-four years. Ten were under thirty years, eight between thirty and fifty, and nine after the age of fifty.

De Berne-Lagarde is likewise of the opinion that age carries no importance with regard to the occurrence of vesical myomata; nevertheless, a large proportion occur between the ages of thirty and fifty.

In the series of vesical myomata studied by Koll, eight occurred between twenty and thirty, two between thirty and forty, four between forty and fifty, and nine after the age of fifty.

Scholl remarks that, while vesical myomata have no age predilection, they are "relatively more frequent in childhood." He follows up this remark with the statement that in a series of forty-one tumors of the bladder in children reported by Concetti, six were myomata.

In the cases reported in the literature we found one under twenty years, seven between the ages of twenty and thirty, eight between thirty and forty, nine between forty and fifty, eleven between fifty and sixty, five after the age of sixty, and in six cases the age was not stated. In the case reported in this paper, the patient was nineteen years of age. It can readily be seen from the foregoing that age is not a significant factor. In this series there were only two cases under twenty—namely, the case reported by Gibbons and Parker and my case.

SEX

It is the general opinion that these tumors occur practically with equal frequency in both sexes.

Scholl states that they have no predilection for sex.

De Berne-Lagarde found nineteen cases of vesical myomata in females and fourteen in males. He also found that the submucous type is almost equally divided between the two sexes, while the type

which develops extrinsically is much more frequent in females (six females, two males). Heitz-Boyer and Dore are of the opinion that sex is of no significance in vesical myomata, having found fifteen in males and thirteen in females.

In the cases reported in the literature there were twenty of vesical myomata in males and twenty-three cases in females. In some of the reports sex is not mentioned. In my case the patient was a female.

SYMPTOMS

Myomata of the bladder may cause no symptoms as is revealed by the fact that in a number of cases they have been incidental findings at autopsy (Faye, Belfield (two), Verhoogen, Riegel, Pashkis, Socin). In Faye's case the tumor was so large that it caused obstruction during delivery, necessitating cephalotomy. The patient died following the instrumental delivery, and at autopsy the tumor was discovered.

In Riegel's, Socin's and Belfield's cases, the tumors developed without any symptoms until they caused obstruction of the ureters, death resulting from this cause. The tumors were discovered at autopsy.

When the tumor is intramural or subserous it develops silently until it creates pressure symptoms which resemble those of any abdominal or pelvic growth. In a number of instances a palpable abdominal tumor has been noted (Levings, Bouchard).

On the other hand, when the tumor is submucous, vesical symptoms occur. In case its location encroaches on the ureteral orifice, symptoms of obstruction may result before the tumor has reached a large size. Complete retention developed in a number of cases (De Berne-Lagarde, Tassi), while various degrees of retention are mentioned in numerous other instances (Kidd and Turnbull, Saturski, Gotzl, Sinclair).

In some instances, it was noted that certain positions facilitated the patient in urinating: the left lateral prone position in Verhoogen's case and the crouching or bending backward position in Freyer's case.

Pain is a symptom frequently mentioned, and is variable in amount. It occurred in Marchant's case and was intense during defecation. In Ramsay's case the pain was said to have resembled that of childbirth.

Frequency is one of the prominent symptoms. Heitz-Boyer and Dore suggest that this may be due to either of two factors: mechanical irritation of the tumor and the constant effort of the bladder to expel it (Volkmann, Freyer, Zuckerkandl and Ramsay), or an associated cystitis (Ramsay, Freyer).

Pus is occasionally present in the urine, depending on the amount of associated pathology (cystitis, pyelitis, et cetera), or the degree of ulceration of the mucosa.

In the submucous type hematuria is the most frequent symptom. Judd is of the opinion that this is due to the distended blood vessels overlying the tumor, or to an intense congestion of the blood vessels of the bladder.

Heitz-Boyer and Dore found hematuria in fifteen out of seventeen cases. Scholl found "profuse hemorrhage a common symptom."

In my case the patient complained of profuse bleeding.

The occurrences of the various symptoms, including those of my case, have been tabulated as follows:

Symptoms	No. Cases
Hematuria	22
Frequency	13
Dysuria	11
Palpable tumor	9
Pain	6
Retention	6
Painful urination	3
Incontinence	1
Urgency	1
Not stated	11

DIAGNOSIS

There are no special signs or symptoms which would allow a clinical diagnosis of vesical myomata to be definitely established. When the growth is subserous or intramural it is hardly to be distinguished from any other pelvic growth, or, if large enough, from any other abdominal tumor. In a number of instances these tumors have been diagnosed as uterine fibroids, ovarian cysts, or various varieties of kidney pathology. In several cases a prostatic tumor or hypertrophy has been considered. In those cases in which the myoma does not impinge on the lumen, cystoscopic examination fails to reveal the tumor, hence the diagnosis is decidedly obscured.

When the growth is endovesical the usual diagnosis has been an

epithelial tumor. This is not surprising when we consider the rareness of myomata, and the fact that in certain instances the overlying mucosa is hypertrophied, or is thinned, due to pressure, or even ulcerated. In such cases the cystoscope would not render aid in ruling out malignancy.

Gotzl, however, diagnosed his case of a submucous tumor of the bladder as a myoma, on cystoscopic examination, being guided by the intact appearance of the overlying mucosa. He states that he has heard of another case diagnosed in a similar way.

Wershub achieved the same results, and stresses the fact that such tumors should be diagnosed correctly through the cystoscopic examination. He states that in the past the diagnosis has usually been established through autopsy findings or "removal of supposed malignant tumors and subsequent microscopic classification as benign tumor growths."

TREATMENT

Surgical treatment was carried out in forty cases. In Saturski's case the pedicle of a submucous tumor was sectioned by cautery. Almost immediately the patient was seized with pains resembling those of labor and expelled the tumor through the dilated urethra. In seven cases in which no surgical treatment was carried out, the tumor was discovered at autopsy.

PROGNOSIS

I am of the opinion that the prognosis in the case of these tumors is much better than in the epithelial type. Naturally, where the growth is attached by a pedicle and the operative removal does not necessitate any wide resection of the bladder wall, the situation is more favorable.

In a number of instances, notably in Kraske's case, it was not possible to remove the entire growth; nevertheless, the patients made a good recovery. In Kraske's case, the patient was well at the end of six years.

The amount of associated pathology naturally influences the prognosis. The three cases in which a hydronephrosis was produced were discovered at autopsy. As I have noted in another instance (Verhoogen), dense adhesions made the operation a very difficult one and the patient died on the second day. In one case

(Kelly and Burman), death, due to infection, followed the operation.

The only report of a recurrence which occurs in our series is the case of Terrier and Hartmann, where the tumor recurred at the end of a year, and again at the end of eighteen months. The patient died, following the third operation. The authors state that at no time did the growth show any evidence of malignant changes.

Our findings of the favorable reports of the outcome of these tumors is in contrast to those of Watson, who finds that in a series of sixteen vesical myomata, "treated by suprapubic operations not resections," thirteen survived. Of these cases recurrences occurred in five instances. Three cases were free from recurrence for one year, and two for more than a year. In his series of four myomata which were subjected to resection, three patients survived, recurrences occurring in two cases, with freedom from recurrence after six years in one case.

It should be stated that, in the cases which we have studied, the reports followed almost directly after the operation, hence what may have developed later on is necessarily not mentioned.

In Scholl's case the patient was known to have been well for eight years, two years in Gronberger's case, and six years in Kraske's.

On the whole the assertion may be honestly made that, owing to the benign nature of these growths, the prognosis is good, provided there is no large degree of associated pathology or no great difficulty in their removal.

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DISCUSSION

Dr. William F. Braasch (Rochester, Minn.): In discussion of Dr. Burns' paper, with reference to spondylolithesis as a possible etiological factor, I would like to report two cases of spondylolisthesis that we observed, causing so-called urogenous disturbance of the bladder, which was corrected by urologic means.

In regard to Dr. Quinby's interesting suggestion I will say that I had the pleasure of working with Dr. Learmouth in his work on bladder innervation and surgical correction, and particularly his work on resection of the presacral nerve, primarily to correct a sympathetic imbalance of bladder control where there was injury of the motor fibers. More recently and also practically simultaneously he suggested the operation for control of pain in the painful bladder, particularly with interstitial cystitis. I would like briefly to show a series of patients that he operated on, cases, which he has reported recently, of interstitial cystitis where the presacral nerve was resected.

(Slide) The time in all these cases has been short, but long enough so that we can get an idea of results. The first case was received nine months ago for interstitial cystitis, with a clinical history of six years. Resection of the sacral nerve and pain was relieved on only one side. Pain has been relieved in a number of cases on only one side.

The second is another case of interstitial cystitis with no relief of pain or frequency. The third had some relief of pain and frequency, about 40 per cent. The next had frequency and some urinary discomfort but none of the excruciating pain. The next had marked relief of pain, only slight relief of frequency. The next had satisfactory relief of pain; complete relief of pain, slight diminution of frequency six months afterward. The next had relief of vesical pain, frequency being relieved. The next had little, if any, relief of pain, and so on.

I think we can safely say that the majority of patients will be relieved of their pain; certainly we can say in 50 per cent, conservatively, if not 60 per cent, that one can promise that much to the patient, but those who have the frequency will not be re-

lieved completely except in a comparatively small per cent. In about half of them it has been reduced but not completely relieved.

More recently of interest also have been the cystoscopic findings in these cases after the presacral nerve resection. In the first place I will not dwell upon the changes in the appearance of the sphincter, but as far as the bladder itself is concerned we will find that sensation will be appreciably diminished; secondly, there will be an engorgement of the blood vessels of the bladder; there will also be a relaxation of the trigon; there will be a relaxation of the ureteral orifices in many cases. As a result of the engorgement of the blood vessels it would seem logical to believe that the interstitial cystitis ought to be relieved by the increased blood supply. That theory has been proven by a marked improvement in the condition of the bladder in appearance, the reduction of the size in areas and also the areas of interstitial cystitis in several of the cases; in others, but very little. The relaxation of the trigon would also probably account, in a measure, for the relief of spasm in the trigon and also the relief of pain to some extent. There was also a diminution in local sense, heat and cold. So these factors unquestionably are of great importance in the results obtained from complete sacral nerve resection.

As far as applying this procedure, however, we of course try the other methods of treatment first, that is, the well known methods of fulguration, application of strong silver nitrate, overdistention and the so-called treatment of strong phenol. We have applied all the well known methods and all these cases have been through those various methods without relief, so that unquestionably the method is applicable. I think we can certainly offer the patient a 50 per cent chance of relief from pain and it should be tried, in our opinion, before cordotomy is used.

Dr. William E. Stevens (San Francisco, Calif.): I saw a case a short time ago which is of interest in connection with Dr. Hamer's paper. One of our best gynecologists had performed a hysterectomy for large fibroids of the uterus and had incised the bladder wall. He sutured it and apparently the patient went along in satisfactory condition for about six days, when she complained of a cough, pain along the anterior costal margin, and on auscultation fine, crepitant râles, distant breath-sounds, and other symptoms suggestive of pneumonia were found. A diagnosis of pneumonia

was made. Two days later, however, there was some swelling in the region of the right costovertebral angle; the patient also complained of dysuria and frequent urination. Operation was advised but refused by the patient for one week. She then consented to operation and on oblique lumbar incision 250 c.c. of foul smelling pus was evacuated, and recovery eventually followed.

I was also very much pleased to hear Dr. O'Conor's paper today. I think we ought to have more papers on urology in women. Unfortunately, there is a tendency to consider all urological conditions in women as gynecology and the gynecologist claims them, and would take them all if we would permit him to have them. I think we should endeavor to combat, at every opportunity we have, the idea that urology in women is a part of gynecology.

Dr. Hugh Cabot (Rochester, Minn.): I want to discuss for a moment Dr. Quinby's paper because, as has Dr. Braasch, I have been able to see the results of Dr. Learmouth's work and have been very favorably impressed. I do not get the impression that Dr. Quinby does as to the vagueness of the so-called sacral nerve. It is not a nerve, of course—it is a plexus—and watching Dr. Learmouth develop it leaves one in no doubt as to the structure. It is a large structure lying over the promontory of the sacrum and very readily shown.

(Slide) This is the picture that Dr. Quinby used. This is the presacral nerve. He has a large number of specimens which were preserved afterward, showing a large ganglion formation.

I had an opportunity of seeing the effects of cordotomy as done by a pupil of Dr. Frazier, and done very well. While I was there at Michigan, Dr. Peet, who worked with Dr. Frazier for many years, did a large number of cases of cordotomy for pain, and, particularly in regard to the patients having vesical pain, that series was very disappointing. For pain of other causes it was much more satisfactory, but nearly half of his patients—he reported forty several years ago—done for relief of vesical pain, were failures, so I think one cannot rely upon cordotomy as a certain method of getting results. As Dr. Quinby points out, it is a much more serious operation.

Learmouth, following Pieri, has recently modified his operation (slide) by making it considerably more extensive in order to get

in the filaments from the lateral nerve. Besides dividing the presacral nerve he divides the filaments here (indicating) and all the way down to the bladder. He has four cases to which that technic has been applied, the last four cases referred to on the list by Dr. Braasch. I have seen, I think, all of his cases. Learmouth is a very cautious person. He certainly will never be found guilty of overstating his case, and in his own conclusions he says that the probability of great relief is about 50 per cent. I think I should be inclined to put it higher. Some of his very irritable patients have been very much relieved. Their frequency, as he points out, is relatively little altered, but they are quite different people, and I believe the operation is at least worth carrying very much further. My experience in watching him has led me to the conclusion that it is an operation for the expert and that most of us will be well advised in letting the experts do it. When one begins to get down around the bladder neck, these structures are not very large and the whiskers that he picks up need some demonstrating. I should be very willing to let these experts follow it out, but I do believe it has a very clear future for bladder pain.

Dr. David W. MacKenzie (Montreal): I wish to report a case similar to this, for we are extremely interested in these cases at present.

This was a doctor who, in 1924, had been examined by one of our members here, a very good man, who thought the affection possibly might be a Hunner ulcer of the bladder. The patient afterward came to Baltimore and was examined by another exceptionally good man, who thought the same thing and resected the ulcer, with no relief. He returned in about two months and a further resection was made, with no relief. He finally came under my attention, in 1926, and I did not feel there was anything we could do very much and referred him to the neurological surgeon for such treatment as he might deem best. At about this time the patient had an operation on his presacral plexus. It was a four-and-a-half-hour operation, done by an exceptionally good man, as Dr. Cabot suggests, one of our experts. The little filaments were looked for and found scattered very irregularly over the territory and pretty well bared around on all sides. Following the operation the patient had no pain whatever for seven months, was perfectly well, and went about his practice. At the end of

seven months he began to complain again, and at the end of twelve months he was worse than before. He is at present on my service in the hospital and wants to have another operation performed to get another seven months' relief. Dr. Penfield, Dr. Kohn, Dr. Archibald and I have talked to him over and over again. What has been done for him just now, which has given him temporary relief until those nerves regenerate, has been to follow an experiment of infiltration around the whole bladder floor. We then operated and resected. He has now no pain in urinating and he is comfortable. The day before I left, in talking with Dr. Kohn, who was with me on the case, I said, "Well, he's very good now, doctor, but how many months will we give him for those nerves to regenerate?" That is as far as we have gone.

DR. RICHARD F. O'NEIL (Boston): Dr. Hamer's paper brought to mind a vesical accident I saw a number of years ago, where an expert cystoscopist passed a cystoscope into the bladder and directly into the abdominal cavity. No undue force was used. The accident was recognized immediately; an immediate laparotomy was performed with suture of the bladder, and no ill result occurred. It was rather extraordinary because it was a contracted tuberculous bladder in a boy of about eighteen.

DR. WILLIAM C. QUINBY (Boston): I am very much pleased, gentlemen, that the results in Rochester, where, of course, the opportunity is very much greater for doing numbers of these various operations, have seemed to be as favorable as we may judge from the reports of Dr. Braasch and Dr. Cabot, and I wish to say that we must, and will, of course, keep an open mind about the whole subject. It is a rather unusually complicated one. There are three sources of pain in the bladder, or at least three possible tracts by which painful sensations may reach the central nervous system from the bladder. That an attack on one member of this triad will be universally successful is hardly to be expected.

We know almost nothing about the powers of regeneration of the fibers in this sympathetic system. We know that they do regenerate and as a rule probably regenerate faster than the ordinary spinal cord fibers, but the whole subject is one for careful observation and continual work.

ANALYSIS OF RESULTS IN 378 CONSECUTIVE CASES OF PERINEAL PROSTATECTOMY

EDWIN DAVIS, M.D.

From the University of Nebraska College of Medicine, Omaha, Nebraska

The charts here presented, analyzing the immediate and late results in a series of 378 consecutive cases of perineal prostatectomy under sacral block anesthesia, represent merely a continuation of similar charts presented before this audience in 1928; the series then totaling 176. Any modification of technic since that time has been unconscious rather than deliberate. Each case in the series has therefore been similarly handled as regards preparatory drainage, choice of time of operation, anesthesia, operative technic, hemostasis and postoperative care.

IMMEDIATE OPERATIVE RESULTS

Table I represents the immediate operative results, with particular reference to mortality. The total number of postoperative deaths, including all deaths from any cause whatever,† during the patient's stay in the hospital, was nine (2.38 per cent). There were no anesthesia deaths, since none occurred earlier than the sixth postoperative day. The latest death, due to old age, lack of resistance, and sepsis, associated with the formation of a large abscess in the calf of the right leg, occurred on the thirty-ninth postoperative day. The causes of death were late general sepsis (three cases), renal insufficiency (three cases), penumonia (one case), pulmonary embolus (one case), and acute cardiac decompensation (one case).

There seems to be justification for the opinion that the chief factors contributing toward maintaining a conspicuously low mortality rate in prostatectomy are (1) adequate preliminary drainage, (2) the perineal route, (3) detailed attention to hemostasis,

†One additional death, which occurred on the *fifty-first* postoperative day (from renal insufficiency), I have considered could be honestly and properly excluded from the series, since this patient was up and fully dressed during the third postoperative week, and had been given permission to leave the hospital. Although the incision was entirely healed, and the urine passing normally per urethra, this patient voluntarily chose to remain in the hospital, awaiting more complete convalescence. Unquestionably, this patient, able to walk, fully dressed, in the hospital corridor, had survived the prostatectomy.

and (4) sacral block anesthesia. There is no occasion for remarking upon the necessity of the first and most important of these (adequate preliminary drainage) before this audience. In this series, preliminary drainage has probably been overdone in many instances, and has been omitted in *no* instance, regardless of the patient's apparent excellent general condition. The minimum drain-

TABLE I

PERINEAL PROSTATECTOMY UNDER SACRAL BLOCK ANESTESIA: IMMEDIATE RESULTS

Total consecutive cases	378
Average age	70
Above eighty	25
Deaths	9
Mortality rate	2.38%
Total consecutive cases with no deaths	121
Sacral anesthesia (consecutive cases without failure)	226
Rectal injury	2
Postoperative "shock"	0
Delayed hemorrhage (several days)	10
Epididymitis	42

age period, arbitrarily chosen, has been ten days. A number of these patients have been returned home with suprapubic drainage tubes for a period of months.

Comparative figures show that the perineal route carries with it a lower hazard than does the suprapubic. It is my opinion that, if for no other reason, this is because abdominal distention or adynamic ileus, so common following suprapubic or abdominal operations, is comparatively rare following operations upon the perineum, whether for prostatectomy, or for other purposes. In the entire series, this distressing and serious postoperative complication has been conspicuously absent.

Immediate postoperative hemorrhage, in every case, has been controlled by means of a combination hemostatic and drainage bag, a detailed description of which has been previously submitted.[1] This rubber bag, inflated with air and maintained in place in the prostatic cavity by means of counter-traction against the perineum (without traversing the urethra), provides hemostasis both during and after the operation. Also in each case, a careful attempt was made to clamp and ligate bleeding points around the bladder neck. For this latter purpose, an excellent opportunity for deliberateness

was provided by the elimination of the necessity for haste, as the result of the sacral anesthesia. Emphasis should be placed upon the importance of minimizing the loss of blood, for the reason that it is undoubtedly true that, although comparatively few patients die as the direct and immediate result of hemorrhage, there are many fatalities occurring later because of lowered resistance and sepsis, resulting indirectly from the spilling of blood. These remarks refer merely to the control of immediate postoperative hemorrhage, occurring during the first two or three postoperative days. The control of immediate post-prostatectomy hemorrhage would seem to be an almost solved problem. Delayed postoperative hemorrhage, however, occurring after a ten-day or two-week interval, often profuse and massive, and coming on suddenly in a patient considered to be out of danger, constitutes a grave menace, and may be considered the chief unsolved problem connected with

TABLE II

PERINEAL PROSTATECTOMY UNDER SACRAL BLOCK ANESTHESIA: LATE FUNCTIONAL RESULTS

		PER CENT
Total questionnaire blanks returned	253	
Patient's own opinion		
Well	207	82
Improved	42	17
Unimproved	4	1
Incontinence		
Complete	0	
Moderate but definite	2	
Slight or doubtful	5	
Nocturia (based upon 100 cases only)		
Not at all or once	43	43
Once or twice	21	21
Two or three times	25	25
Four or more	11	11
Urinary fistula		
Complete	0	
Slight, but requiring closure	7	
Urethro-rectal fistula		
Immediate	0	
Late	2	

prostatectomy today. At any rate, there is no other complication so serious, so unforeseen, and which we are so wholly unable to prevent. Fortunately, this is a rare complication (approximately 2 per cent), and one which might well pass unnoticed in a small series.

Sacral block anesthesia, the fourth factor in minimizing the mortality rate, unquestionably plays an important rôle. This opinion is justified because there have been no anesthesia deaths in the series, and no alarming anesthesia reactions. The outstanding feature is that these patients return to their beds in the same condition, with respect to circulation and general appearance, as before the operation. Whatever postoperative "shock" may be, this condition is conspicuously absent following the perineal operation, under sacral anesthesia.

Finally, it is to be noted with respect to mortality, that there is a certain definite and inevitable death rate during the prostatic

TABLE III

CLASSIFICATION OF PATIENTS WITH PROSTATIC OBSTRUCTION

		PER CENT
Total number of urological consultations during 21 months between June, 1929, and March, 1931	1336	
Total number of patients with prostatic obstruction seen during this same period	200	
Carcinoma	18	9
Prostatectomy performed	118	59
Symptoms insufficient to justify prostatectomy	19	9.5
Operation refused or postponed by patient	32	16
Died during retention catheter drainage	1	0.5
Died following suprapubic drainage	3	1.5
Sent home with suprapubic drainage tube—decision pending	6	3
Prostatectomy considered hopeless on account of patient's condition	3	1.5
	200	

hypertrophy age, occurring from various causes, with or without operation. The so-called American Experience Tables of Mortality, which are used as a legal standard for actuarial computations by life insurance companies, show that out of a total of 1,000 individuals, living at the age of seventy, slightly more than 6 per cent are expected to die from "natural causes" (without operation) before reaching the age of seventy-one. Since the average prostatectomy patient is under observation over a period of almost two months, it is logical to assume that a 1 per cent mortality rate may therefore be accounted for by "natural causes" wholly unrelated to the prostatectomy. Although this would seem to be rather a

theoretical consideration, this observation is borne out by facts, since three (and perhaps four) of the nine deaths included in this series merely happened to occur during convalescence, and were in no way associated with the operation. These figures tend to emphasize further the statement that the mortality rate, due to the operative procedure itself, may be reduced to almost *nil*.

It may be stated that the problems of (1) renal insufficiency, (2) anesthesia, and (3) immediate postoperative hemorrhage may be considered to be practically solved by (1) preliminary drainage, (2) sacral anesthesia, and (3) hemorrhage controlling devices, respectively. One is therefore justified in the opinion that the chief hazard of prostatectomy (or at least, the only wholly uncontrolled hazard) is that due to delayed massive hemorrhage, occurring unexpectedly as late as the end of the second postoperative week, in a patient in apparently excellent condition. This complication is as unforeseen and unpreventable as pulmonary embolus. There were ten such cases in this series. Although there was no death in the series due directly to hemorrhage (either immediate or late), delayed hemorrhage of this kind, with resulting lowered resistance, was considered to have been an important contributing factor in two of the three deaths due to late general sepsis.

LATE FUNCTIONAL RESULTS

With respect to late functional results following prostatectomy, it is to be recognized primarily that perfection, or even approximate perfection, is out of the question. Prostatectomy, always performed at a time of life when the human machine has passed its prime, and often in advanced old age, has to deal with a body which has developed many defects, some of which are due directly to months or years of urinary obstruction and infection, and some of which occur as the inevitable consequence of old age. Under these circumstances, complete restoration to normal, with complete disappearance of symptoms, so that the patient is willing to consider himself "well," is impossible in many instances, even though the purpose of the operation (relief of urinary obstruction) has been accomplished.

The only method of obtaining fairly accurate information as to late functional results (after an interval of several months) is by the use of questionnaire blanks. Those of you who have attempted

to obtain information by this method recognize this as a tedious and rather unsatisfactory process, beset with difficulties and inaccuracies at best. The beginning of the series here presented dates back to the beginning of the routine use of sacral block anesthesia, in 1924. Since the first group of questionnaire blanks was not sent out until 1928, information concerning many of the early cases is lacking. The total number from whom it has been possible to obtain direct information is 253, as outlined in Table II. The remainder, not included, is made up of those who have subsequently died, those with address unknown, and those failing to reply. The percentages indicated in Table II, however, based upon 253 consecutive available replies, may certainly be considered to represent an accurate cross section of the entire series. Later in the series the percentage of accurate information has been much higher. In fact, in the last 100 cases, the questionnaire blank failed to return in four cases only. These four have been omitted from the series, although each is known to have left the hospital with a satisfactory functional result.

TABLE IV

SACRAL BLOCK ANESTHESIA FAILURES IN PERINEAL PROSTATECTOMY

	NUMBER FAILURES	PERCENTAGE FAILURE
Analysis of first 100 cases:		
First 25 cases	5	20
Second 25 cases	4	16
Third 25 cases	2	8
Fourth 25 cases	1	4
Total first 100 cases	12	12
Analysis total series of 378 cases:		
First 100 cases	12	12
Second 100 cases	1	1
Third 100 cases	0	0
Last 78 cases	0	0
Total 378 cases	13	3.4
Total number of failures last 278 cases	1 (0.35 per cent)	
Total number of failures last 226 cases	0	
Time necessary for complete block		
Average	12.5 min.	
Maximum	30 min.	
Minimum	4.5 min.	

(Note—"Identical" technic in all cases.)

Each questionnaire blank included merely the following simple, direct questions.

1. Is the wound entirely healed?
2. Can you control the urine?
3. Do you pass urine too often?
4. How many times do you get up at night to urinate?
5. Does the urine pass without difficulty?
6. As far as the operation is concerned, do you consider yourself (1) well, or (2) improved, or (3) unimproved?

The last question, "Are you well, improved, or unimproved?" was considered to be by far the most important, since the patient's reply to this represents his own unbiased opinion as to what was accomplished by the operation. It need not be pointed out before this audience that replies to this important question, received from a large number of old men in various walks of life, many of them more or less ignorant or childish, and some of them mentally incompetent, would naturally tend to be statistically unfavorable. Many of these replies are therefore based upon whim and fancy, rather than upon a careful consideration of whether or not the mechanical urinary obstruction was relieved. This opinion is confirmed by an analysis of the questionnaire blanks, showing that many of these old men, in excellent condition as far as wound healing, urinary control and absence of residual are concerned, classify themselves as "improved," rather than "well," merely on account of varying degrees of persistent urinary frequency, secondary to deep-seated and irremediable urinary tract infection. Others place themselves in the improved group on account of swollen ankles, shortness of breath, or indigestion, or other wholly unrelated causes. In spite of these natural unfavorable tendencies, however, 82 per cent (207 of the 253) have classified themselves as well, 17 per cent as improved, and 1 per cent as unimproved.

There is also difficulty in obtaining accurate and fair information upon the subject of urinary control. The possibility of injury to the external sphincter during the perineal operation is an acknowledged hazard which is not to be minimized. There is no case in the series of complete urinary incontinence. There are two patients, however, who unquestionably have sufficient difficulty with urinary control to be the cause of very real inconvenience, although each has the power of sphincter action, as evidenced by the ability to

start and stop the urinary stream several times while voiding. Table II also includes a group of five cases of slight or doubtful incontinence giving such answers to the question concerning urinary control as "not always," or "most of the time," or "fairly well, but not perfectly." It is difficult to evaluate or interpret such replies fairly. In addition, there were three patients giving somewhat similar replies who were excluded from this group because subsequent personal conversation with the patient or his physician satisfactorily demonstrated that the condition was one of occasional urinary urgency due to infection, rather than to true sphincter weakness. Possibly, this figure could be further minimized if there were the opportunity for personal conversation with the other five. It is likely that the cases of true sphincter weakness cited above, occurred as the result of faulty operative technic. It is true, however, that the occasional case of sphincter weakness is observed after the suprapubic operation, and hence may be considered to be dependent upon individual anatomical variation in the strength of the musculature making up the external sphincter.

The tendency toward the persistence of varying degrees of urinary frequency, in a large percentage of these patients, even after the urinary obstruction has been relieved, would seem to be rather disappointing, as well as surprising. The figures in Table II, having to do with the subject of postoperative urinary frequency, are based upon one hundred consecutive replies only, yet these figures should be fairly representative. Only 43 per cent of these patients are so entirely normal as to find themselves getting up not at all, or only once, each night; while 21 per cent report once or twice; and 25 per cent two or three times. In spite of imperfection in this respect, however, 82 per cent of these patients voluntarily classify themselves as "well."

There has been no case of complete permanent perineal urinary fistula. Seven patients have had a slight persistent fistula, with leakage of a few drops of urine with each urination. In six of these, this condition has been sufficiently annoying to justify secondary excision of the fistulous tract. Five of these closed following this procedure. The only patient with a fistula persisting after secondary excision shows a four plus Wassermann test.

Urethrorectal fistula, while always a possibility without due care in prevention, is so rare a complication as not to require serious

consideration. In one case this complication developed on the tenth postoperative day, although there had been no knowledge of rectal injury at operation; in another, at the end of the fifth postoperative week, after the patient had returned home. This latter patient had had persistent fever, suggesting a deep perineal abscess as the etiological factor. In two additional cases of known rectal injury at operation, urethrorectal fistula was prevented by a method of suprapubic aspiration to be published later. With proper operative technic, and with the use of methods of prevention, this complication is, therefore, exceedingly rare. Furthermore, existing urethrorectal fistula, while a very serious and distressing condition, is by no means hopeless, since the radical "exaggerated Whitehead" operation, described by Young and Stone,[2] offers an excellent method of cure.

SELECTION OF CASES

The question next arises as to how great a factor in minimizing the mortality rate the selection of cases has been, and what percentage of these patients in frank need of relief from prostatic obstruction have been denied the operation by reason of physical disability. There are those who might inquire as to how many patients have been sentenced to suffering for the sake of statistics. In an effort to obtain accurate data upon this subject, the records of the last consecutive 200 patients, who have come in for consultation *on account of prostatic obstruction,* have been reviewed. These 200 prostatic patients were seen during the twenty-one months included between June 20, 1929, and March 24, 1931. These patients have been divided into groups as shown in Table III.

It is interesting to note that of 200 consecutive patients presenting themselves on account of varying degrees of prostatic obstruction, 41 per cent (for varying reasons as outlined in Table III) never came to prostatectomy. None of these, however, is of particular interest excepting those dying during the drainage period, and those considered inoperable. One died in gradually increasing uremia, after five weeks of retention catheter drainage. Of the three deaths following suprapubic drainage, one (on the fourth postoperative day) was considered to be due to cerebral hemorrhage or cardiac failure, and another (on the thirty-first postoperative day) was proved to be due to pulmonary embolus. The

third death in this class occurred at the end of six weeks. This patient had a carcinoma of the bladder, in addition to the prostatic hypertrophy.

The opinion has been submitted that deaths following suprapubic drainage should be included in figuring prostatectomy mortality. This is perhaps a debatable question, but would seem to be hardly fair. Under such an assumption, no value whatever is placed upon the judgment and discretion of the surgeon. In each case, suprapubic drainage, was carried out because relief from suffering was imperative. If it is true that the three deaths following suprapubic drainage should be included in the prostatectomy mortality, then it is likewise true and just as logical that the patient dying during retention catheter drainage should also be included. To carry this argument to its absurd conclusion, it might be stated that every prostatic patient seen in consultation, and subsequently dying, with or without operation, should be included in figuring prostatectomy mortality.

There were only three patients (1.5 per cent) in such physical condition that prostatectomy was definitely decided to be hopeless and out of the question. Two of these (Nos. 4599 and 5281) were weak, frail old men in the eighties, with extremely poor functional tests. The decision in these two cases was based more upon general appearance and condition of circulation, rather than upon age and functional tests. The third (No. 5302) was a man of sixty in the advanced stages of cardiac decompensation. This patient died after six weeks of interval catheterization.

The last group for consideration is made up of those patients (numbering six) sent home with suprapubic drainage tubes, with the decision pending, as to the advisability and date of prostatectomy. One of these (No. 5158) chose to continue indefinitely with the drainage tube and died after an interval of more than one year. As nearly as may be determined by recent communication, each of the other five (Nos. 1619, 5268, 5270, 5575 and 5616) is in good condition and in shape for prostatectomy when and if he chooses to return.

There is no occasion for referring to, or reciting in detail, the case histories of the large number of patients in this series upon whom prostatectomy was successfully performed, in spite of a wide variety of serious physical defects. It is sufficient to state

merely that the prostatectomy list includes many grave risks, and that the minimum number excluded was made up of those in which it would have been obvious folly to proceed.

SACRAL BLOCK ANESTHESIA

In reviewing this series it is also of interest to direct attention to results in sacral block anesthesia as shown in Table IV. Those of you who are familiar with the literature upon this subject are aware that one of the chief objections to this method of anesthesia has been that many observers have reported a certain small but inevitable percentage of cases in which there was inexplicable failure to obtain anesthesia. My own original series of thirty cases of perineal prostatectomy under sacral block anesthesia[1] included seven cases in which additional inhalation anesthesia was necessary. This represented 23 per cent of failure.

The series here presented consists of 378 consecutive cases of perineal prostatectomy, similarly handled. Each one of these, without exception, received sacral block anesthesia, consisting of a caudal injection, and injection of the first, second and third posterior sacral foramina, as outlined above. As indicated in Table IV, the percentage of anesthesia failure, which was very high early in the series (20 per cent in the first twenty-five cases), has shown a gradual decrease during the first hundred cases, and has now come to be *nil*. The total number of failures in the first 100 cases was twelve, of which nine occurred during the first fifty. Since the first 100 cases there has been one failure only (No. 149), and, following this, there have been 229 consecutive cases without a failure, in a series which is as yet uninterrupted.

As here employed, the term "sacral anesthesia failure" means that supplementary inhalation anesthesia was necessary. Every case where nitrous oxide or ether was employed has been counted, whether used throughout the operation or whether "only a few whiffs" were given, and whether the general anesthesia was necessary because of actual pain or merely for "psychic" reasons. In fact, in no case in which the anesthesia was classed as successful was there an ether mask or a nitrous oxide apparatus in the operating room during the operation. There is, therefore, no occasion for classifying these anesthesias as successful and "fairly successful." Each anesthesia was a complete success or a complete failure,

as determined by whether or not the operation was completed without supplementary inhalation anesthesia.

The feature of practical interest is the gradual decrease in the percentage of failure during the first hundred of the series. In all cases, the same operation was performed, and the same position on the table was employed. Also the same amount of the same drug in the same concentration was used, as well as the same type of needles and, as nearly as it was humanly possible to determine, the same technic of injection. That is to say, there has been no deliberate modification of technic. The same anesthetist has performed the injections in all cases. Therefore, since all of these controllable factors have been constant, the only permissible conclusion is that success or failure is wholly dependent upon whether or not the needles have been accurately placed within the caudal canal and the sacral foramina, *and upon no other factor.* There is, therefore, no occasion for further reference to the percentage of inexplicable failure with sacral block anesthesia. If the anesthetist searches, and continues to search, for the foramina until he finds them, and knows that he has found them, the anesthesia will be successful. The percentage of success is therefore a matter of practice and perseverance.

SUMMARY

There have been nine deaths in a consecutive series of 378 cases of perineal prostatectomy under sacral block anesthesia (2.38 per cent).

The chief factors contributing toward maintaining a low mortality rate in prostatectomy are (1) adequate preliminary drainage, (2) the perineal route, (3) detailed attention to hemostasis, and (4) sacral block anesthesia.

The chief uncontrolled and unavoidable hazard of prostatectomy today is massive *delayed* hemorrhage, coming on as late as the end of the second week, and occurring in 2 per cent of cases.

As determined by questionnaire blanks sent out after intervals of several months following prostatectomy, 82 per cent of these patients voluntarily classify themselves as well, 17 per cent improved and 1 per cent unimproved. By far the chief reason why these patients tend to classify themselves as improved rather than

well, is the persistence of varying degrees of urinary frequency, due to deep-seated and irremediable urinary tract infection.

With respect to the matter of selection of cases, out of a total of 200 consecutive patients presenting themselves with varying degrees of prostatic obstruction, 118 were submitted to prostatectomy, six were sent home with suprapubic drainage tubes, with the decision pending as to the advisability of prostatectomy, while in three instances the patient's condition was considered such as definitely to contraindicate any consideration of prostatectomy.

The technic of sacral block anesthesia (for prostatectomy) may be made sufficiently exact so that the percentage of failure, formerly considered inevitable, may be entirely eliminated. In a series as yet uninterrupted, it has been possible to employ sacral block anesthesia for perineal prostatectomy in 229 consecutive cases without a single anesthesia failure.

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THE OCCURRENCE OF COLD ABSCESS OF THE PROSTATE

ALEXANDER RANDALL, M.D., F.A.C.S.
Philadelphia, Pennsylvania

It would seem, at times, as though our branch of medicine was as heavily encumbered with the shackles of fundamentalism as some of the certainties of Divinity. I fear, at times, that we are losing that questioning attitude that has brought medicine so far on its road of progress. Certainly, it seems that society discussions rarely assume the sparkle of debate that we picture of the past, and the members seem to lack that firmness of conviction that leads to reasoning with a fervor that convinces all doubting minds. Absence of a questioning attitude makes us too ready to believe a reasonable half truth, and for this "crass credulity, so widespread today," Osler says, "there is no more potent antidote than the healthy skepticism bred of long study in the postmortem room."

Variability is a law of life, and the problems of disease are more complicated, more variable than any other: for no two individuals react alike and behave alike under the abnormal conditions which we know as disease. Yet, how often do we find a self-opinionated authority laying down a law for the origin or the progress of a pathologic process.

Into Urology from somewhere, at some time, came the dictum that tuberculosis has its origin in the glomerulus of the kidney for the urinary tract, and the upper pole of the epididymis for the genital tract. That the former statement is now generally accepted as false, we will allow. That the second is equally fallacious, I will attempt to prove.

Barney[1] has been particularly energetic in furthering the theory that the epididymis is the primary lesion in the genital tract, and has devoted a great deal of interest and study to the subject for twenty years. At the 1927 meeting of the Societé Internationale he claims to have "furnished unquestionable proof that the disease arises primarily in the epididymis." In his recent publication[2] he admits that Walker of London presented a "convincing argument in favor

of the prostatic origin of the disease," and ends his article with the thought that "perhaps Gamberini is right when he says 'in the actual state of our knowledge we cannot assert which is the most frequent starting point of the tuberculous process.' "

Lehman,[5] in a recently published study directed essentially to the elucidation of the point of the origin of tuberculosis in the male genital organs, concludes that primary involvement of the prostate is frequent and claims that he could definitely show that in seventeen instances of the eighty-six cases studied at autopsy, the original focus was either in the prostate or seminal vesicle.

One could continue to cite other students of this problem, such as Uchimura,[7] Cunningham,[3] Sussig,[6] Dillon,[4] or Wildbolz,[8] who likewise hold views differing from the majority on this subject, but my particular plea is why should anyone deny to the prostate the possibility of being the seat of the primary genital lesion, and why should the epididymis be so exclusively honored?

In analyzing a series of 1,215 postmortem examinations, I encountered sixteen examples of abscess of the prostate.

The majority of cases of prostatic abscess that are recognized clinically are the acute infections; they are generally diagnosed early and are either drained surgically, or spontaneously evacuate themselves. Yet, there are few surgeons of large experience who have not, at some time or another, operated with the intention of removing an obstructing prostatic growth, only to find an abscess the cause of the urinary difficulty. As Samuel D. Gross has aptly said, "The formation of abscess of the prostate is not always announced by characteristic phenomena." It is significant, in this group of sixteen cases of prostatic abscess, that only two could be classified as *acute* infectious processes. Five others were subacute, and infection from the pyogenic group of organisms was recognized as the cause; while in the remaining nine instances the prostatic abscess was of tuberculous origin. These nine cases of cold abscess represent 56.2 per cent of the group of sixteen cases, and as 343 patients of the autopsy series died of tuberculosis, these nine cold abscesses represent 2.6 per cent of those so diseased.

These nine cases occurred in patients of the following ages: twenty-seven, twenty-seven, thirty-two, thirty-four, thirty-eight thirty-eight, forty, fifty-five and fifty-six years respectively. Let me

briefly detail these cases to show the fallacy of the generalization that genital tuberculosis must have its origin in the epididymis.

Case 1.—Death was due to pulmonary tuberculosis; there was a generalized tuberculous prostatitis with a caseated abscess of the right lobe, and involvement of the right seminal vesicle, vas and right epididymis.

Case 2.—Death was from pulmonary tuberculosis with a solitary abscess in the right prostatic lobe that involved four-fifths of that side of the prostate. The left lobe was uninvolved, and no lesions could be found in the seminal vesicles, vasa or epididymi. This patient had a conglomerate tuberculous peritonitis, tuberculosis of spleen, adrenal, and the glands over the right external iliac vessels, causing edema of the right leg. On the other hand, the kidneys were normal on gross and microscopic study, as were also the ureters and the bladder.

Case 3.—Death again was due to pulmonary tuberculosis with a solitary abscess in the left prostatic lobe, and a left epididymitis. There was a history of an "acute orchitis" (epididymitis) four years and two years before death. Sections of this testicular lesion could not be proven tuberculous, and stains for the tubercle bacillus were negative. His Wassermann test was plus four. The kidneys, ureters and bladder were negative.

Case 4.—This patient died of pulmonary tuberculosis: there was a unilateral renal tuberculosis, a tuberculous cystitis, and a prostatic abscess in the posterior commissural glandular tissue simulating a commissural hypertrophy. Again, there was neither epididymitis nor seminal vesiculitis present.

Case 5.—This patient, also dying of pulmonary tuberculosis, showed a prostatic abscess and a tuberculous seminal vesiculitis on the right side. There was no epididymitis, and no cystitis.

Case 6.—This patient died of generalized miliary tuberculosis. The kidneys showed miliary tuberculosis, but no gross lesions. Gross and microscopic tuberculosis were demonstrable in the left epididymis and left seminal vesicle. The right testis, epididymis and seminal vesicle were microscopically normal. The prostate was the seat of a large generalized abscess of older date.

Case 7.—This patient died of pulmonary tuberculosis: there was a left-sided tuberculous pyelonephritis and a tuberculous cystitis. The abscess again occurred in the posterior commissural tissue and its protrusion appeared subtrigonal; while search failed to reveal any evidence of vesiculitis, vasitis, or epididymitis.

Case 8.—This patient, aged fifty-five years, had pulmonary tuberculosis, a psoas abscess, and suppurative bilateral pyelonephrosis, ureteritis, and cystitis. There appeared to be a subcervical lobe enlargement, though actually it was an abscess; there was no lateral lobe enlargement but an abscess cavity occupied the area of each lateral lobe. Thus, three lobes of the prostate were each the seat of a separate abscess, again without epididymitis, or seminal vesiculitis. It is but fair to point out that though this man had a typical ulcerative pulmonary tuberculosis, tubercle bacilli were not found in his sputum, nor in the pus of the psoas abscess, nor in the kidneys: also no Pott's disease was demonstrable, and cultures from the psoas abscess showed staphylococcus aureus. Hence, though the gross picture was characteristic, the bacteriological demonstration of the tubercle bacillus was lacking in this case.

Case 9.—This patient, aged fifty-six years, had generalized miliary tuberculosis, with a tuberculous abscess in the left prostatic lobe and a left tuberculous seminal vesiculitis. The right seminal vesicle, both vasa, and both epididymi, were uninvolved, as was also the urinary tract.

Briefly summarizing the involvement in these nine instances of tuberculous abscess of the prostate, we find that two had generalized miliary tuberculosis; one had a very generalized chronic tuberculosis, and the remaining six died of the major rôle of a pulmonary phthisis. Three times the prostatic abscess was associated with urinary tract tuberculosis without involvement of other genital organs; four times the genital tract was the seat of concomitant (or shall we say primary) disease, without the urinary tract being involved. In one instance there was a generalized involvement by a miliary process, and in one case there was a solitary tuberculous abscess in the right prostatic lobe without either urinary or other genital tract lesions. Six times there was no epididymitis accompanying the prostatic abscess; five times there was no seminal vesiculitis demonstrable. Once there was epididymitis without vesiculitis, and twice there was vesiculitis without epididymitis. As regards the local prostatic lesion, we find that three times the abscess was limited to the right lobe, twice to the left lobe alone, and twice to the posterior commissure alone. In one instance, the entire gland was destroyed and formed a single abscess cavity; while most remarkable of all was Case 8, where three separate and definite abscesses occupied the area of the glandular tissue of right and left lateral lobes, and an Albarran hypertrophic lobe to boot.

These are interesting figures to ponder over, and they unquestionably vitiate the accepted teaching, for from the above one can certainly conclude that tuberculosis can be primary in the prostate, and that the gland may be involved in any of its anatomical parts, or any combination of them.

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CARCINOMA OF THE PROSTATE

BENJAMIN S. BARRINGER, M.D.
New York, N. Y.

Carcinoma of the prostate still holds its place as the most baffling of urological conditions. We know little of its etiology. In but a small percentage of cases is the diagnosis made sufficiently early to give any sort of treatment a fair chance of success. Even if an early diagnosis be made there is no general agreement as to the best way to treat this neoplasm. We hold that the possibilities of radical surgery have been thoroughly exploited while the effective use of radiation is still far from the practical limits of its application to this disease. This paper is written in an attempt to analyze the reasons for the failures of the past, to discuss our present ideas on the subject and to suggest further improvement in the control of the disease by radiation.

THE ANATOMY OF PROSTATIC CANCER

Young and Gerraghty first demonstrated that in the majority of cases the prostatic cancer begins in the posterior lobe, the lobe of the prostate which lies between the fascia of the bladder base and the fascia of Dénonvillier. The evidence confirming this is that in many cases the cancer lies fully beneath the urethra; that section of the removed prostates have shown the growth to be wholly in the posterior lobe; that both the lateral and median lobes, the site of hypertrophy, are found after removal to contain no cancer, yet in the same case cancer may be present in the posterior lobe. The cancer may start in the posterior lobe wholly within the two confining fascias and invade the lymphatics around the seminal vesicles and through to the pelvic nodes. Or it may invade the glands of Albarran and the other lobes of the prostate or directly break through into the bladder.

Urinary retention, benign or cancerous in origin, may be a complication.

Of 315 cases of prostatic cancer a punch operation was performed through the urethra for urinary retention in seventy-nine

cases. In but fifty-one cases or 64 per cent was cancer present in the removed specimen.

The cancer may be primary in the lateral and median lobes or there may be multiple foci of origin in different prostatic lobes. The type of malignancy varies considerably. Grade 1, relatively

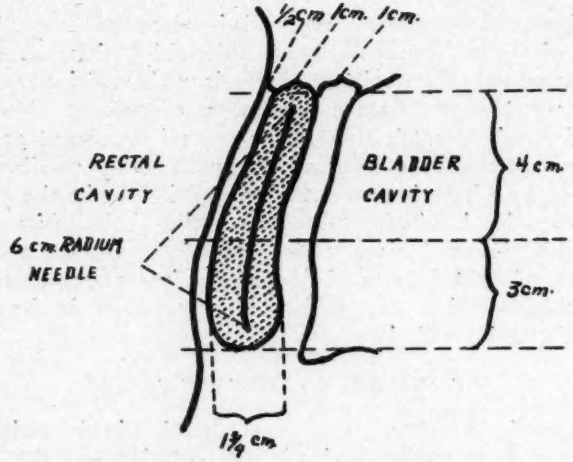

Fig. 1. Semi-lateral view of radiated prostate and area around seminal vesicles.

radio-insensitive, is much the commonest type. The carcinoma may be confined to the prostatic and the periprostatic region for a relatively long time or it may invade the lymphatics very early and likewise the bones, most frequently those of the lumbar spine and pelvis. The cases in which the best results may be expected are those in which the diagnosis is not made previous to operation and a small carcinomatous area is found in the removed prostate. It has been my experience in such cases that few patients are cured by the operation. In most of them there are either foci of the carcinoma present in the periprostatic tissue or the manipulations of the operation are responsible for squeezing out cancer cells into the surrounding tissue. They therefore have to be closely watched for recurrences.

The second class of favorable cases consists of those in which the carcinoma is, as far as can be determined, between the fascia of the bladder base and that of Dénonvillier. In these cases the diagnosis can generally be made by palpation and this should be confirmed by the aspiration method as developed by Ferguson and

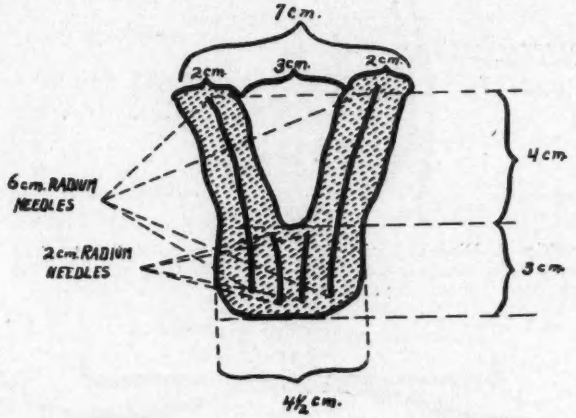

Fig. 2. Antero-posterior view of radiated prostate and area around seminal vesicles.

Ellis. These cases are particularly favorable for radiation if there is no retention of urine. Retention of urine may complicate the picture. In this class the carcinoma is in one plane. The area to be radiated is shown in Figure 1, and, after many experiences with different kinds and forms of radiation, I believe that this type is best radiated by means of needles implanted in the perineum with a guiding finger in the rectum.

The third most favorable class is that in which the cancer begins in the posterior lobe, invades the glands of Albarran and the other lobes of the prostate and possibly breaks through into the bladder neck itself, but is not large and is confined to these areas. This type is to be attacked by the suprapubic operation and the implantation of radium seeds. In these cases the original one plane of Class 2 is complicated by the addition of the third dimension and it is sometimes impossible by our present methods to radiate effectively all of

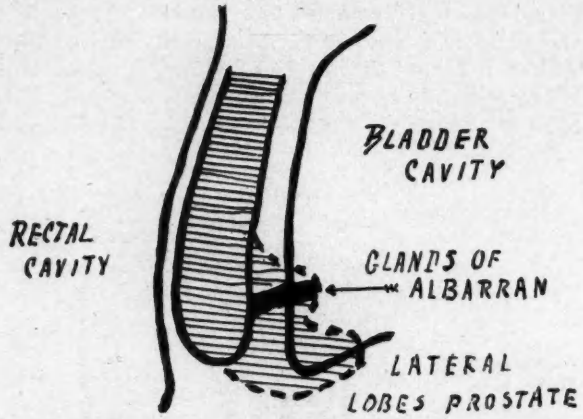

Fig. 3. Diagrammatic view of area to be radiated when carcinoma breaks through and invades glands of Albarran and the lateral lobes of prostate.

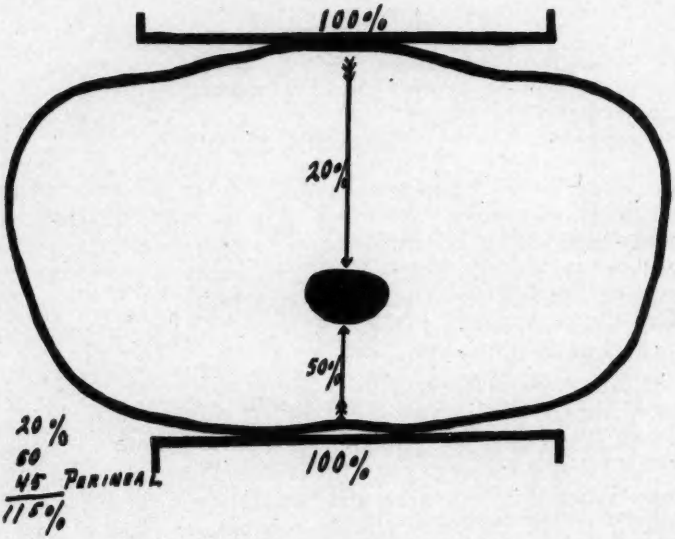

Fig. 4. Deep X-ray therapy using three portals of entry and delivering 115 per cent into prostate.

the carcinomatous area. Ferguson, of the Memorial Hospital, New York City, has devised an instrument of precision for implanting gold seeds into such a prostate. This promises much and may be a final solution. If there is no definite invasion of the glands of Albarran and the rest of the prostate and no retention of urine I

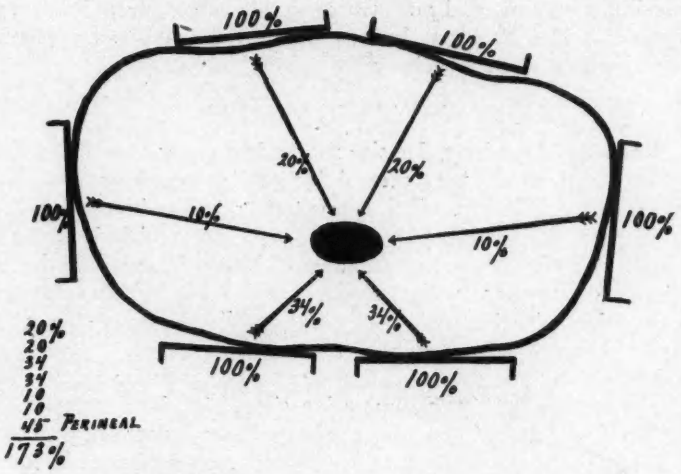

Fig. 5. Deep X-ray therapy using seven portals of entry and delivering 173 per cent into prostate.

am very loath to open up the bladder. This increases our mortality by probably 4 or 5 per cent, and if it only increases our percentage of cures by a like percentage then we gain nothing. If urinary retention due to carcinoma complicates the picture then a suprapubic operation is indicated. The obstructing portion should be most carefully dealt with and the tearing operation by means of the finger should be avoided as this tends to disseminate the cancer. Some sort of punch operation through the suprapubic wound is, I believe, better.

Rectal irradiation does not produce good results in my hands. The rectal mucous membrane is more affected than the prostatic cancer and the after-results of such radiation are apt to be painful and even dangerous.

Deep roentgen-ray therapy is ineffective as far as the control of the cancer is concerned. This is shown by the charts. The maximum dose in the prostatic cancer itself is less than two erythema doses, and personal experience has shown that most prostatic cancers, as is the case with bladder cancer, require probably ten or more erythema doses to control. On the other hand if we are considering symptoms and not control of the cancer deep X-ray therapy is valuable. Pain may be immensely helped and bone metastases may often be definitely checked.

SUMMARY OF RADIATION

Prostates of the irregular size shown in Figures 1 and 2, and from 1 to 1.5 cm. thick, are radiated by gold screened needles placed through the perineum. Such a prostatic cancer will tolerate from 1,000 to 1,500 millicurie hours of radiation, which is to be repeated in from two to three months. The primary radiation apparently does not make the second radiation less affective. If there is retention of urine due to fibrous constriction or benign hypertrophy this should be dealt with as a separate entity.

If there is retention of urine due to prostatic invasion of the bladder neck a suprapubic operation should be done, the obstructing portion punched out and the remaining cancer implanted by gold seeds of a strength 1 to 1.5 mc. to each cubic centimeter of cancer.

If these methods are used we can control between 10 and 15 per cent of prostatic cancer.

172 E. 79th St.

THE UROLOGICAL ASPECTS OF RADIO-SENSITIVE TUMORS OF THE BLOOD-FORMING ORGANS

J. DELLINGER BARNEY, M.D.
FRANCIS T. HUNTER, M.D.
and
E. ROSS MINTZ, M.D.

From the Urological and Medical Departments, Massachusetts General Hospital, Boston

By radiosensitive tumors of the blood-forming organs we refer to those tumors which are derived from primitive cells of the lymph nodes, bone marrow and spleen whose normal maturation gives rise to adult forms seen in normal blood, namely, lymphocytes and cells of the myelocytic series (polymorphonuclear neutrophiles, eosinophiles, and basophiles). Tumors derived from the primitive endothelial cells of the lymph nodes and marrow, whose normal maturation produces the large mononuclear cell seen in normal blood, are so rare that they have not been included in this paper. Following the terminology of Mallory we have chosen the terms "lymphoblastoma" and "myeloblastoma" to designate these tumors, as the unqualified use of various terms such as "malignant lymphoma," "lymphosarcoma," "pseudoleukemia," "spleno-myelogenous leukemia," and so forth, have in the past only added to the confusion now prevalent in the literature. There has been less confusion in regard to the myeloblastoma, as this tumor usually expresses itself in a characteristic clinical picture, *i.e.*, enlargement of the spleen with leukemia. It may be either acute or chronic and have a leukemic or an aleukemic blood picture, but as a rule the diagnosis may be made by a careful examination of the stained blood smear.

This is not the case with the lymphoblastomata, however, and hence the multiplication of terminology which would give the impression that these are several separate diseases, whereas, to our knowledge so far, we are probably dealing with different manifestations of one disease. In regard to this Minot and Isaacs[6] say, "One of the big problems of modern medicine is to unravel the nature of the group of conditions that have progressive enlarge-

ment of the lymphoid tissue as their most prominent feature. Classification leads to clarification and yet confusion arises from sharp distinctions between conditions that have many resemblances, which may be because some of the conditions are but different phases of the same disease. This is the state of affairs for those disorders with unknown etiology that may be placed under the general heading of lymphoblastoma, a name considered by some as synonymous with malignant lymphoma. It is highly desirable to have uniform terminology and to distinguish the differences of cases falling into this large group here termed lymphoblastoma."

Without any attempt to imply differences of etiology we have for convenience subgrouped the lymphoblastomata into six clinical types depending on clinical, hematological, or histological features. The first clinical type, Lymphatic Leukemia, is characterized by a high white cell count, with lymphocytes predominating, enlarged spleen and general adenopathy. The second type, Aleukemic Lymphatic Leukemia, may have the same clinical picture but the white count is either normal or subnormal, and the percentage of lymphocytes usually runs quite high, 65 to 95 per cent. The third type, Hodgkin's Disease, often has a different clinical course, the blood is not definitely remarkable, but the differentiation from the other types can be made by the typical histological appearance of the tumor. The fourth type, Mycosis Fungoides, is almost universally conceded by dermatologists to belong to the lymphoblastoma group and we think should be subclassified because of the predominance of skin lesions. The fifth group in the past has been called not only Lymphosarcoma but also "Small Round Cell Sarcoma": its characteristic feature is that it invades outside the capsule of the lymph gland in contradistinction to all the other types, is less radiosensitive and often has a more rapid course than the others. The sixth and last type which we call Non-leukemia, is called also Pseudo-leukemia, Lymphadenoma and by various other terms, depending upon the fancy of the writer. This type is characterized by a negative blood picture and general adenopathy with no tendency of the tumor to infiltrate outside the gland capsule. The histology is not characteristic and may give the same picture as a leukemic gland.

It should be remembered that these types are not absolutely distinct and separate as an individual case may be leukemic at one

time, aleukemic later on and finally show lymphosarcomatous infiltrations at postmorten examination. The same is true of cases of the other types. This grouping or typing is offered merely as a working classification and has no claim to infallibility.

And finally we have used the term "radiosensitive" to describe these tumors for the simple reason that there are very few other tumors which show such remarkable response to X-ray and radium as do the lymphoblastomata and the myeloblastomata. The fact that both of these tumors are generalized and widespread, often long before the patient sees a doctor, makes one convinced that operations, except for diagnosis, are seldom justified, and that the only wise form of therapy lies in X-ray or radium.

It may well be asked why these tumors in any of their forms concern the urologist. While it is true that they do not often concern him, personal experience and a careful review of the literature for the past ten years shows that the urologist must be fully informed not only as to the nature of the diseases under discussion but also as to their ability to involve the urinary and genital organs. Although the literature contains but few references to the urological aspects of these tumors certain well defined cases are recorded which because of signs or symptoms referable directly or indirectly to the genito-urinary tract were seen by urologists. Also by reading between the lines one can easily convince himself that in many other reported instances, especially those recorded as "sarcoma" or "round cell sarcoma," the case was perhaps some form of lymphoblastoma.

Instances of lymphoblastoma involving the kidney either by direct invasion or by pressure have been described by Variot and Cailliau,[11] by Price,[7] and by Mathé.[5] Colby[3] has reported an involvement of both testicles whose original symptoms arose from a tumor in the nasopharynx. Lymphoblastoma of the prostate has been recorded by Lowsley and Harrah,[4] Symmers,[9] Blatt and Markus,[2] and by Quinby.[8] The latter cites three similar cases reported some years ago, one by Coupland, another by Kaufman and a third by Conforti and Favento. Only recently two other cases of prostatic lymphoblastoma have been seen at the Massachusetts General Hospital, one by Swan, the other by G. G. Smith (personal communication). Szenes[10] has described a case involving the bladder, uterus, ovaries, and tubes.

While involvement of the genito-urinary tract (except for hematuria) by myeloblastoma, is usually not sufficient to direct attention to that system, one of us (J. D. B.)[1] has recently reported a case of priapism as a complication of myeloblastoma (myeloid leukemia). The diagnosis was made on clinical evidence only. The probability is that this patient is now dead. The case is not included in our group of autopsies.

In view of the fact that one of us (F. T. H.) has made a study of the clinical manifestations of the blood tumors for some years past and that several cases involving the genito-urinary tract have been seen within a comparatively short time by the writers and by various members of the Urological Department at the Massachusetts General Hospital, we have examined our autopsy records for the past ten years. A total of fifty-one cases has been collected. Of these, thirty-nine were lymphoblastoma and twelve myeloblastoma. Of the thirty-nine cases of lymphoblastoma thirteen showed clinical signs and symptoms together with gross or microscopic pathological findings for which a urologist might be or actually was called into consultation; in ten, while there were no clinical urological manifestations of the disease, the pathologist found gross or microscopic evidences of it. In the remaining sixteen there was no involvement whatever of the genito-urinary organs. Of the twelve cases of myeloblastoma two showed signs or symptoms pointing to the genito-urinary tract; eight had no signs or symptoms but postmortem examination revealed either infiltrations of the tumor or purpuric hemorrhages into various parts of the genito-urinary tract, particularly the kidney, while in two cases there were neither signs or symptoms nor involvement even microscopically. In brief there was involvement of the genito-urinary tract in thirty-three of fifty-one cases of these tumors (64.7 per cent). These are arranged in Table I.

In the fifteen cases (thirteen lymphoblastoma, two myeloblastoma) showing signs or symptoms, the urologist was or might have been asked to give an explanation of a mass in one or both flanks in six cases, of an enlarged prostate with more or less retention in one case, of pain in the back in four cases, of a marked enlargement of the testis (bilateral in one) in two cases, and of hematuria and pyuria in seven cases. These signs and symptoms occurred singly or in one or another combination. In one instance the signs

and many of the symptoms were so suggestive of left perinephric abscess that the patient was about to be operated for this disease. An eleventh hour consultation averted this and attention was directed to the spleen, which was found at operation to be an enormous necrotic mass of lymphoblastoma. In this case the preoperative diagnosis was made more obscure by a negative blood picture and an absence of enlarged glands. In another case the presence of a severe cystitis with persistent pyuria, intermittent pyrexia together with a dilated and infected right kidney pelvis led to an exploration

TABLE I

	Signs and symptoms	No signs and symptoms	Negative	Totals
Lymphoblastoma				
Leukemia	5	3	4	12
Aleukemia	1	1	1	3
Hodgkin's	2	1	2	5
Mycosis fungoides	0	2	2	4
Lymphosarcoma	1	0	0	1
Non-leukemia	4	2	6	12
Unclassified	0	1	1	2
Total	13	10	16	39
Myeloblastoma				
Myeloid leukemia	2	8	2	12
Total	15	18	18	51

of the kidney. During convalescence further blood studies and the development of and a biopsy upon an enlarged cervical gland showed the case to be one of the Hodgkin's type of lymphoblastoma.

It is obvious from what has been said that the urologist may be called to see these cases for various conditions. In the lymphoblastomata there may be pain referred to the kidney region with or without palpable tumor. An infiltration or invasion of the kidneys up to the point of replacement with tumor tissue may produce anuria, oliguria, or uremia. A similar process involving the ureter and producing constriction may result in renal colic, pyelonephritis or pyonephrosis; in fact, complete obstruction of one or both ureters may even occur. Invasion of the bladder primarily or by way of the prostate can produce marked disturbance of urinary function including retention.

Pyuria and hematuria, gross or microscopic, may of course result from any of the conditions described above or these symptoms may be produced by minute or microscopic involvement of the urinary organs. Repression of urine due to invasion of the brain by a leukemic type of lymphoblastoma has been seen by one of us (F. T. H.). In this instance the only other evidence of brain involvement, besides the repression of urine, was mental sluggishness which might have been interpreted as an early symptom of uremia. Postmorten examination showed no evidence of involvement of the urinary tract whatsoever. (This case has not been included in our series of autopsies.) Invasion of the testis may simulate neoplastic tumors of the more usual type and experience has shown that even after orchidectomy the tumor may persist and develop in the stump of the spermatic cord. Marked involvement of the epididymes and spermatic cords into the inguinal canal was seen by one of the writers (J. D. B.). The patient had been ill over a long period of time and had been studied by various internists and surgeons. While it was thought that he had malignancy somewhere, no definite diagnosis was made. The tumor formation described above occurred during the last few weeks of life. At autopsy a diagnosis of aleukemic leukemia was made.

Myeloblastoma, or myeloid leukemia if you prefer, in contrast to lymphoblastoma, does not so often invade the urinary system, but, due to the general purpuric tendency usually seen sooner or later in its course, frequently gives rise to gross or microscopic hematuria. In addition to hematuria one may find blood in the stools, ecchymoses of the skin or bleeding from the gums. It is well known that the leukemias, especially those of the myelogenous type, frequently have a high uric acid content in the blood and these may develop "sand" and even calculi of this composition.

Priapism of the most pronounced and persistent type may appear in the course of this tumor. Although certain of the textbooks state that this unfortunate complication is not uncommon the case already referred to above is the only one so far seen in our clinic.

In certain cases the genito-urinary symptoms may develop early and may be the reason for the patient's consulting the urologist first of all; in others these symptoms may be a more or less late manifestation of the disease. It is, therefore, important that the urologist should have at least a rudimentary knowledge of the

signs and symptoms of this group of blood tumors so that if possible he may not only make his diagnosis early but also avoid what may be entirely futile surgical interference. We can go so far as to say that if in any case pain in the back or flanks is the chief complaint and careful study reveals no pathology in the urinary tract, lymphoblastoma should be considered. In this circumstance the urologist may do well to look for some of the less obvious signs of this disease. Careful and repeated blood smears, examined if necessary by a trained pathologist or internist, will often reveal the diagnosis. The superficial glands of the body should be examined, especially those in the posterior triangle of the neck (being careful to exclude the adenitis found with pediculosis capitis or infections of the scalp), the supraclavicular region, the femoral triangle and the axillary region. In fact, a lymph gland of more than 1 or 2 cm. in diameter, no matter where it is located, should be regarded with suspicion and a biopsy done if it seems justifiable. We have sometimes, especially in thin individuals, been able to palpate a mass of enlarged glands in one or the other iliac fossa, the examination being made much more easily with the patient lying on his back with his knees flexed on the abdomen. An X-ray examination may be of the utmost value and clear up an otherwise obscure diagnosis. It may show an involvement of the peritracheal or peribronchial glands; it may even reveal a metastatic tumor of the spine as a cause of pain in the back. These steps in the procedure of making a diagnosis may result in success where without them a correct solution would not be reached. None of them are difficult or time consuming and all can be carried out by the urologist himself or by his medical colleagues.

No matter in what part of the body these tumors are discovered it must be remembered that they are but a local manifestation of a generalized disease of the blood-forming organs. In this way it very much resembles tuberculosis with its well known tendency to declare itself first in one organ or system and then in another.

Treatment.—Once the diagnosis is established the only rational treatment is deep X-ray therapy or in special instances radium externally applied. As in all types of generalized malignant tumors frequent and careful physical examinations are necessary to detect in the early stages invasions in other parts of the body, and to

institute therapy if possible before symptoms (such as those due to mediastinal pressure, et cetera) have become marked. The assistance of the trained radiologist and internist may make all the difference in the world to the patient as far as comfort is concerned. Surgery is almost always contra-indicated except for purposes of diagnosis, or, rarely, for the relief of symptoms when radiation therapy has failed to alleviate.

Prognosis.—Both types of tumors are universally fatal. The myeloblastomata usually produce death in two to four years in chronic cases, in six weeks to six months in the acute type. In the lymphoblastomata prognosis is much more difficult. In the longest case in this clinic without involvement of the genito-urinary tract, the patient died seventeen years after biopsy, but the average live two to four years if there is no involvement of vital organs early in the disease. It is obvious that the part of the body involved by the tumor shapes the prognosis in the individual cases; that in a case of replacement of both kidneys by tumor tissue death can not be far away, while in a case of invasion of the testis the immediate prognosis is nowhere near so grave.

CONCLUSIONS

1. The so-called "radiosensitive" tumors which we have described under the terms lymphoblastoma and myeloblastoma are derived from the primitive cells of the lymph nodes, bone marrow, and spleen. While the myeloblastomata are characterized by enlargement of the spleen with leukemia, the lymphoblastomata have very varied characteristics and for this reason have been more or less arbitrarily divided into six classes or subdivisions. It should be remembered, however, that these types are not absolutely distinct as in the same patient the picture may be first of one and then of another type.

2. These tumors are called "radiosensitive" because of their remarkable response to the influence of X-ray or radium and for this reason surgery is generally not only contra-indicated but futile.

3. The literature contains but very few authentic cases of such involvement, a fact to be explained perhaps by a failure to make a correct diagnosis more often.

4. Out of fifty-one autopsies studied by us, in conjunction with the clinical records we have found thirty-nine cases of lymphoblastoma, and twelve of myeloblastoma. Of the lymphoblastoma thirteen, or 33 per cent, showed clinical signs or symptoms referable to the genito-urinary tract, while ten more showed a greater or less involvement at autopsy, giving a total of 58.9 per cent which concern the urologist. Of the twelve myeloblastomata two, or 16.6 per cent, showed clinical signs and symptoms while in eight others lesions of the genito-urinary organs were discovered only by the pathologist. Thus in this group 83.3 per cent showed evidences of the disease in the genito-urinary system.

5. The urologist may see cases of tumors of the blood-forming organs because of a mass in the loin, a pain in the back, retention of urine, enlarged prostate, tumor of testicle or epididymis, pyuria, hematuria, or priapism. These symptoms, single or in combination, may occur early or at any time during the course of the disease.

6. In any case where one or another of the tumors described is suspected one should do careful and repeated studies of the blood smears; examine carefuly for enlarged glands, doing a biopsy if necessary, and have an X-ray examination of the chest and spine.

7. The only rational treatment of these tumors is deep X-ray therapy and in some cases external applications of radium. This treatment should be instituted as soon as possible after the diagnosis is made. It, therefore, follows that the urologist should cooperate with the radiologist and the internist.

8. The prognosis in all types of the tumors referred to here is always fatal. The length of life depends upon the type of tumor, upon the reaction of the individual patient to his tumor, and upon the involvement of vital organs such as the kidneys.

The protocols of cases studied in this communication follow:

PROTOCOLS OF CASES

With Clinical Signs and Symptoms

A. LEUKEMIA—5 cases.

1. Male, aged eighty-one years. The bladder was over-distended; a large, irregular hard mass like prostate encircled the rectum. Uremia and hematuria were present. Cervical axillary and inguinal glands were palpable. Urine was loaded with pus. Blood count was: Red cells, 3,720,000; white cells, 124,000; polymorphonuclears, 13 per cent; lymphocytes, 80 per cent; large mononuclears, 2 per cent; eosin-

ophiles, 5 per cent. There was marked infiltration of spleen, duodenum, and jejunum, mesenteric and retroperitoneal glands. Kidneys and bladder were largely replaced by tumor tissue, which invaded and encircled the prostate.

2. Male, aged two years, five months. The patient had fever for a few days, and a progressive anemia. A firm, smooth mass in the left upper quadrant was shown by intraperitoneal injection of air to be the left kidney; general adenopathy. Urine examination was negative. Blood count was: Red cells, 3,200,000 to 1,980,000; white cells, 7,000 to 50,000; polymorphonuclears, 3 per cent; lymphocytes, 94 per cent; large mononuclears, 2 per cent; transitionals, .05 per cent; normoblasts, 0.5 per cent. Mesenteric and retroperitoneal glands were enlarged. Kidneys, especially the left, showed extensive lymphoid infiltration.

3. Male, aged seventy-one years. The patient complained of dyspnea, cough, hoarseness, sore throat, diarrhea, marked loss of weight. Urine showed albumin, pus, blood and casts. Spleen and liver were palpable. Superficial glands were enlarged. Blood count was: Red cells, 3,260,000; white cells, 242,000; polymorphonuclears, 2 per cent; lymphocytes, 97 per cent; mononuclears, 1 per cent; eosinophiles, 0; basophiles, 0. Mesenteric and retroperitoneal glands were enlarged; kidneys were grossly normal but showed microscopic areas of lymphocytic infiltration, especially in cortex.

4. Male, aged twenty-four years: Complaints were of dyspnea, cough, nocturia. There was a plum-sized mass above the umbilicus. Urine examination was negative. Testes were hard, the size of a hen's egg. Biopsy of superficial gland revealed lymphoma. X-ray showed large mass filling mediastinum. Urine examination was negative. There was purpura of the skin before death. Blood count was: Red cells, 7,688,000; white cells, 6,900—white cells, later, 96,800; polymorphonuclears, 68 per cent; lymphocytes, 24 per cent; large mononuclears, 8 per cent. Later, polymorphonuclears were 8 per cent; lymphocytes, 92 per cent, all small type. Retroperitoneal glands were much enlarged, especially near the head of the pancreas. Kidneys and testes were extensively infiltrated with lymphomatous tissue.

5. Male, aged three months, 13 days. Both kidneys were enlarged. There was ecchymosis of the left scrotum. Urine showed few red and white cells. Blood count was: Red cells, 3,656,000; white cells, 265,000; polymorphonuclears, 2 to 4 per cent; lymphocytes, 85 to 90 per cent; mononuclears, 6 to 12 per cent. Mesenteric and retroperitoneal glands were much enlarged. Stomach and intestines showed marked infiltration. Kidneys were much enlarged and infiltrated. Ureters showed many nodules of infiltrating tumor. Both testes showed infiltration.

B. Aleukemia—1 case.

1. Male, aged 79 years. The patient gave a long history. There were intermittent masses in the abdomen. Several blood smears

showed increased percentage of lymphocytes. Spleen was palpable. There was ecchymosis of hands and feet. X-ray showed rarefaction of spine and ilia. There was bilateral hydrocele with epididymitis and funiculitis, also pyrexia. Retroperitioneal and mesenteric glands were enlarged showing infiltrations with atypical lymphocytes and lymphoblasts. Prostate showed the same infiltration. Spleen contained atypical cells consisting of myeloblasts and lymphoblasts.

C. HODGKIN'S DISEASE—2 cases.

1. Female, aged fifty-eight years. The patient had intermittent pyrexia, loss of strength, cystitis, pyuria; right hydronephrosis with pyelitis and cystitis. Biopsy of cervical gland revealed lymphoblastoma (Hodgkin's type).

2. Male, aged twenty-nine years. There had been a mass in the left upper quadrant, two months. Urine examination was negative. He suffered pain, loss of weight, weakness. There was a superficial adenopathy. Biopsy revealed lymphoblastoma (Hodgkin's). Mesenteric and retroperitoneal glands formed a solid mass of tumor involving the right kidney and replacing the left.

D. LYMPHOSARCOMA—1 case.

1. Male, aged seven years. There was pain and swelling of the face. Diagnosis was sarcoma of jaw. Biopsy revealed lymphosarcoma. There was a mass the size of a grapefruit in each flank. Urine examination was negative except for albumin. There was infiltration of stomach, duodenum and ileum. Retroperitoneal and mesenteric glands were enlarged. Kidneys were both much enlarged and infiltrated.

E. NON-LEUKEMIA—4 cases.

1. Male, aged fifty-two years. There had been pain on the left side four months; no genito-urinary symptoms. Urine examination was negative. There was dullness and mass in the left upper quadrant. Pyelogram showed deformity and downward displacement of the left kidney. Diagnosis at first was perinephric abscess, later abscess of spleen. Blood count was: Red cells, 5,000,000; white cells, 7,500 to 19,600; polymorphonuclears, 72 per cent; lymphocytes, 15 per cent; large mononuclears, 11 per cent; eosinophiles, 2 per cent; basophiles, 0. There was extensive lymphoblastomatous infiltration of spleen, stomach, retroperitoneal glands and pancreas.

2. Male, age undetermined. The patient had pain in the lower abdomen, distention, jaundice. Urine showed red and white cells. Superficial glands were enlarged. Blood count was: Red cells, 4,690,000; white cells, 10,700; polymorphonuclears, 86 per cent; lymphocytes, 10 per cent; mononuclears, 2 per cent; eosinophiles, 2 per cent. Biopsy of axillary gland revealed lymphoblastoma (non-leukemic type). Retroperitoneal and mesenteric glands formed a large mass involving especially the head of the pancreas. Both kidneys were much enlarged.

3. Female, aged sixty-five years. The patient had suffered pain six months in the back, hips, and lower abdomen. Later there was retention of urine. The left side of the abdomen was occupied by a large tumor. Urine examination was negative, as was also the X-ray examination. Blood count was: Red cells, 4,800,000; white cells, 4,000; polymorphonuclears, 61 per cent; lymphocytes, 29 per cent; eosinophiles, 1 per cent; mononuclears, 2 per cent. Retroperitoneal space especially on the left was filled by a large irregular mass of tumor tissue. Kidneys and ureters showed extensive infiltration.

4. Male, aged sixty-three years. There was nasal obstruction. The tumor mass was treated with radium. Diagnosis was carcinoma. Later there was tumor of both testes and a bilateral orchidectomy was performed. Diagnosis was lymphoblastoma. Later hoarseness and dysphagia appeared. Superficial glands were much enlarged. Kidneys were infiltrated with tumor.

F. Myelogenous Leukemia—2 cases.

1. Male, aged thirty-two years. The patient complained of hematuria and bleeding gums. Urine was almost pure blood; stools contained blood. Blood count was: Red cells, 3,240,000; white cells, 17,800; polymorphonuclears, 3 per cent; lymphocytes, 15 per cent; mononuclears, 5 per cent; basophiles, 0; myelocytes, 76 per cent. Kidneys showed marked focal infiltration.

2. Male, age undetermined. There had been intermittent pain in the left upper quadrant three years, with weakness, dyspnea, loss of weight. Urine showed much pus and uric acid crystals. Spleen was enlarged. Blood count was: White cells, 200,000; polymorphonuclears, 17 per cent; myeloblasts, 4 per cent; eosinophiles, 0; basophiles, 1 per cent; large mononuclears, 1 per cent; lymphocytes, 77 per cent. Kidneys were infiltrated. There were cystin calculi in the bladder.

Without Clinical Signs or Symptoms

A. Leukemia—3 cases.

1. Female, aged forty-five years. There were purpuric spots on the body. Blood count was: Red cells, 2,400,000; white cells, 24,000; polymorphonuclears, 1 per cent; eosinophiles, 1 per cent; small lymphocytes, 11 per cent; large lymphocytes, 82 per cent; myelocytes, 4 per cent; atypical, 1 per cent. There was microscopic infiltration of the kidneys.

2. Male, aged thirty-five years. Blood count was: Red cells, 1,380,000; white cells, 28,800; polymorphonuclears, 2 per cent; lymphocytes, 94 per cent; basophiles, 1 per cent; myelocytes, 3 per cent. Mesenteric and retroperitoneal glands were enlarged; kidneys showed microscopic infiltration.

3. Male, age undetermined. The patient had swollen glands three years. Blood count was: Red cells, 2,770,000; white cells, 406,400; polymorphonuclears, 1 per cent; small lymphocytes, 84 per cent; large

lymphocytes, 12 per cent; large mononuclears, 3 per cent. Kidneys showed massive infiltration, as did the prostate.

B. ALEUKEMIA—1 case.

1. Male, aged sixty-eight years. There were purpuric spots on the body. Biopsy of glands revealed malignant lymphoma. Blood count was: Red cells, 4,680,000; white cells, 6,400; polymorphonuclears, 24 per cent; lymphocytes, 14 per cent; mononuclears, 20 per cent; unclassified, 42 per cent. Retroperitoneal glands were enlarged, spleen grossly involved, kidney tissue replaced here and there with atypical lymphoid tissue.

C. HODGKIN'S DISEASE—1 case.

1. Male, aged forty-three years. There was upper abdominal pain and enlarged glands, epigastric distress, edema of ankles. Blood count was: Red cells, 4,300,000; white cells, 5,600; polymorphonuclears, 61 per cent; lymphocytes, 25 per cent; mononuclears, 12 per cent; eosinophiles, 2 per cent. Mesenteric and retroperitoneal glands were much enlarged, ureters thickened and bound down by mass of glands.

D. MYCOSIS FUNGOIDES—2 cases.

1. Male, aged twenty-one years. The patient complained of skin eruptions, sore throat and loss of weight. Blood count was: Red cells, 4,000,000; white cells, 5,300; polymorphonuclears, 75 per cent; lymphocytes, 16 per cent; large mononuclears, 4 per cent; eosinophiles, 1 per cent; myelocytes, 4 per cent. There were tumor nodules in the skin, and the kidneys showed infiltration.

2. Male, aged thirty-five years. Skin was studded with tumor nodules, retroperitoneal glands were enlarged, superficial glands were enlarged, and the kidneys showed infiltration.

E. NON-LEUKEMIA—2 cases.

1. Male, aged sixty-two years. Blood count was: White cells, 16,000; polymorphonuclears, 60 per cent. Mesenteric and retroperitoneal glands were much enlarged. Kidneys showed microscopic infiltration.

2. Male, aged fifty-six years. There was bilateral costal pain and superficial adenopathy. Blood count was: Red cells, 5,000,000; white cells, 13,600; polymorphonuclears, 75 per cent; lymphocytes, 22 per cent; mononuclears, 3 per cent. Peritoneum and mesentery were infiltrated, also the pancreas and liver. A tumor mass was in the lower pole of each kidney.

F. UNCLASSIFIED LYMPHOBLASTOMA—1 case.

1. Female, aged fifty-five years. The patient complained of abdominal distention and pain. Mesenteric and retroperitoneal glands were enlarged, omentum, intestines, and mesentery invaded. There were tumor nodules in the right kidney.

G. Myelogenous Leukemia—8 cases.

1. Female, aged eighteen years. There had been pain in the back and joints for two months; weakness, loss of weight, epistaxis recently. Liver and spleen were palpable. Blood count was: Red cells, 3,800,000; white cells, 102,300; polymorphonuclears, 5 per cent; lymphocytes, 7 per cent; myelocytes, ?; neutrophiles, 3 per cent; eosinophiles, 1 per cent; basophiles, 1 per cent; myeloblasts, 83 per cent. Skin showed petechiæ. The mesenteric and retroperitoneal glands were enlarged. Kidneys showed infiltration.

2. Female, aged forty-two years. Complaint was superficial adenopathy. Blood count was: Red cells, 1,480,000; white cells, 224,000; polymorphonuclears, 5 per cent; lymphocytes, 7 per cent; large mononuclear neutrophiles, 0; eosinophiles, 1 per cent; basophiles, 4 per cent; myelocytes, 21 per cent; myeloblasts, 62 per cent. Retroperitoneal glands were enlarged, kidneys showed tumor infiltration.

3. Male, aged nine months. The patient entered the hospital for swelling of the right eye. There was also purpura of the chest, and he died nine hours later. Blood count was: Red cells, 5,100,000; white cells, 126,000; polymorphonuclears, 2 per cent; large lymphocytes, 42 per cent; small lymphocytes, 43 per cent; large mononuclears, 5 per cent, unclassified, 7 per cent. There was marked involvement of retroperitoneal and mesenteric glands, intestines, stomach, kidneys, ureters and bladder.

4. Male, aged sixty-one years. Complained of loss of weight and enlarged spleen. Blood count was: Red cells, 2,780,000; white cells, 115,000; polymorphonuclears, 16 per cent; mononuclears, 3 per cent; basophiles, 1.5 per cent; lymphocytes, 1 per cent; myeloblasts, 6.5 per cent; myelocytes, 70 per cent. Axillary glands and glands of neck enlarged, liver and spleen much enlarged. Kidney pelvis and ureters contained much pale, yellow-brown sand.

5. Sex and age undetermined. Mesenteric and retroperitoneal glands were enlarged, kidneys showed microscopic infiltration.

6. Female, aged forty-seven years. There was generalized adenopathy. Blood count was: Red cells, 3,090,000; white cells, 172,000; polymorphonuclears, 1 per cent; lymphocytes, 5 per cent; eosinophiles, 1 per cent; myeloblasts, 90 per cent; normoblasts, 3 per cent. Mesenteric glands were much enlarged. Kidneys showed microscopic infiltration of the medulla.

7. Male, aged forty-four years. There was a mass in the right groin. Blood count was: Red cells, 3,750,000; white cells, 485,000; polymorphonuclears, 34 per cent; lymphocytes, 2 per cent; myelocytes, 38 per cent; transitional, 36 per cent. Retroperitoneal and mesenteric glands were enlarged; ileum showed infiltration. Kidneys showed microscopic infiltration of the interstitial tissue of the pyramids.

8. Female, aged fifty-three years. The patient was admitted in coma. Blood count was: White cells, 80,000; few normal polynuclears

and lymphocytes, several basophiles, many large abnormal cells of bone marrow series. There was leukemic infiltration of the spleen, liver, myocardium, and retroperitoneal glands. Kidneys showed microscopic tuberculosis, and there was leukemic hyperplasia of the bone marrow.

NOTE: Protocols have been given only of those cases showing clinical signs or symptoms and of those showing involvement of the genito-urinary tract at autopsy, but no clinical signs or symptoms. The arrangement is somewhat different from that given in Table I. In some cases the data are incomplete but are sufficient in our judgment to enable us to make an unqualified statement as to the diagnosis. Only positive findings have been recorded. In many cases the blood picture varied considerably; generally the blood picture at the time of entering the hospital has been given.

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A STUDY OF THE PELVIC FASCIÆ IN RELATION TO THE OPERATION OF SUPRAPUBIC CYSTOTOMY

HENRY H. MORTON, M.D., F.A.C.S.
Brooklyn, New York

Of all the operations which the urologist is called upon to perform, suprapubic cystotomy is probably the most frequent, its object being to make accessible the interior of the bladder for the purposes of drainage or removing the prostate and foreign bodies, or the treatment or removal of new growths. Suprapubic cystotomy was first introduced into surgery by Pierre Franco in 1561 and then dropped out of sight for a hundred years until revived by Mercier in 1635. Again it disappeared from practice until 1723, when Douglas, of London, performed the operation in four cases successfully, and in 1727 Cheselden operated six times with one death.

At this time suprapubic cystotomy was superseded by the perineal operation and again had its hundred years' sleep until 1879 when, under the auspices of Garsen and Petersen, it came to the fore again.

Its success depends upon the anatomical fact that when the bladder is filled with from four to six ounces of water it rises out of the pelvis, leaving a space 1.5 inches long uncovered by peritoneum, called the space of Retzius, through which the bladder can be easily entered without wounding the peritoneum with its contained omentum and intestines lying safely out of the way on the vault of the bladder.

There are certain anatomical points, however, in relation to the various layers of fascia investing the anterior surface of the bladder which should be remembered.

After incising the skin and fat and going through the linea alba between the rectus muscles, the surgeon meets with the transversalis fascia. When this is divided, the fascia umbilico-vesicæ (fascia Faraboeuf) is encountered. The upper part of this fascia is attached above to the transversalis fascia near the umbilicus and below to the lower part of the symphysis. At its lower extremity it splits, the anterior part being attached to the symphysis and the

posterior part connected with the surface of the bladder and extending downward toward the prostate.

In order to avoid wounding the peritoneum accidentally, it is a common practice among surgeons to push upward the fold of peritoneum covering the upper part of the bladder with gauze, after the bladder has been brought into view. The effect of this rough

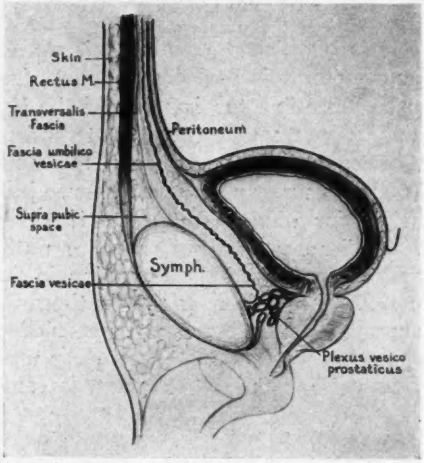

Fig. 1. Abdomino-pelvic fascia.

disturbance of the relation of fascia vesicæ and bladder is to open up into the cellular tissue a very considerable space lying behind the symphysis. This space is very liable to be filled with urine which leaks around the drainage tube lying in the bladder and is often converted into a pool of stagnant decomposing urine which has poor drainage and may be converted into a sloughing septic wound, from which a pericystitis or general sepsis may arise.

A simple method of avoiding opening up the postpubic space is as follows:

The bladder is filled with water and the usual longitudinal incision made through the skin, fat, linea alba and transversalis fascia. With wide retraction of the wound the fascia umbilico-vesicæ is divided, not in the longitudinal direction, as is usually practiced,

but transversely, using light strokes of a sharp scalpel until the muscular fibers of the bladder wall are well exposed. This maneuver leaves the part of the fascia umbilico-vesicæ below the transverse incision closely attached to the lower half of the bladder, and its lower end is fast to the symphysis, thus closing in completely the postpubic space so no leakage of urine can get to it. The

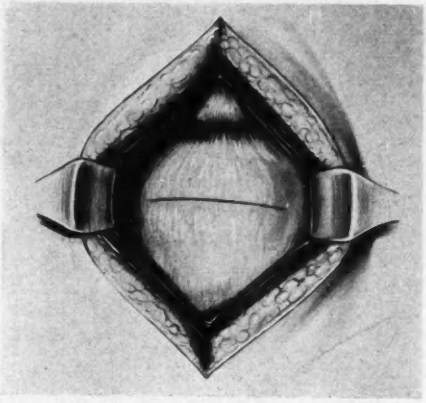

Fig. 2. Distended bladder covered by fascia umbilico-vesicæ. Fascia divided transversely.

upper part of the fascia vesicæ above the transverse incision which is still attached to the bladder wall can be pushed back with gauze, carrying the fold of peritoneum as far as the urachus, with which the peritoneum is so intimately bound that it will tear if forcible attempts are made to push the peritoneum beyond that point.

If it is desired to extraperitonize the bladder at this stage of the operation, this may be accomplished by Voelcker's technic.

The bladder having now been exposed and the fascia vesicæ and the peritoneal fold having been pushed out of the way, and the postpubic space protected by the lower fold of the fascia vesicæ, it now remains to open the bladder. The usual direction in which the incision is made is longitudinal. There are, however, many advantages in opening the bladder by a transverse incision through the

muscular and mucous coats. If stay sutures are introduced at the upper and lower margins of the proposed incision, the bladder may be steadied and held while a sharp-pointed bistoury is plunged through its wall, a large tube inserted into the bladder will carry off the injected water, and when the bladder is dry the incision may be enlarged laterally on one or both sides to any extent desired.

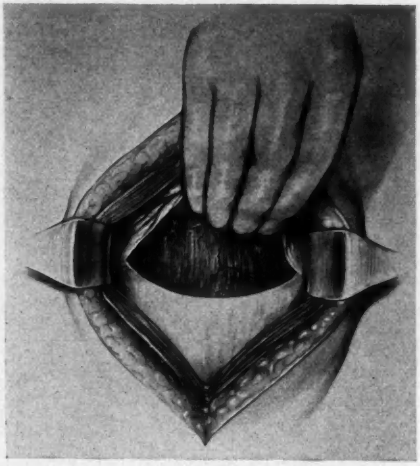

Fig. 3. Fascia umbilico-vesicæ divided transversely and pushed upward with peritoneal fold, exposing muscular coat and veins of bladder.

The advantages of the transverse incision in the bladder wall over the usual longitudinal incision are several: First, the incision may be enlarged to one side or the other to afford inspection of the cavity of the bladder or resection of a part of its wall. Secondly, on suturing the bladder the whole line of incision is within easy reach of the surgeon's eye and hand. Thirdly, quite a good sized cup of natural uncut bladder at the base is left, which holds the urine better than if the incision were carried down to the lower part of the bladder, and the formation of this natural cup is aided by the ease with which the incision may be made higher up towards the fundus, and also the greater facility in complete suturing around

the drain, for it is not always easy to put a suture in the lower angle of the bladder wound behind the pubis when the longitudinal incision has been made.

The question has been raised as to whether these transverse incisions in the bladder wall heal as rapidly as the longitudinal ones. In my work in the last four years I have invariably used the trans-

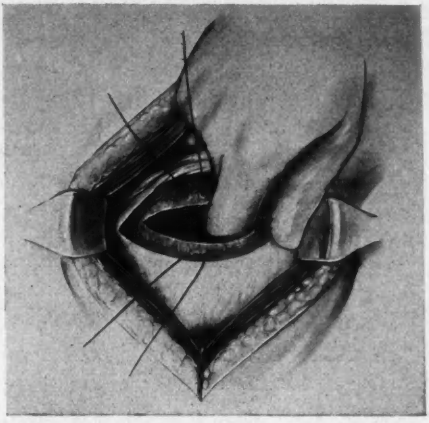

Fig. 4. Bladder held with stay sutures and opened transversely.

verse incision after careful division of the fascia umbilico-vesicæ and I find that patients with the transverse incision heal as quickly and as surely as others did when I used the longitudinal incision.

I might add in closing that I always use a rubber angled tube to drain the bladder after opening it; this is left in for about a week. I also leave the lower angle of the abdominal wound wide open with a small drain or gauze tampon carried between the rectus muscles down to the bladder to afford drainage for any possible leak round the bladder drainage tube.

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DISCUSSION

DR. J. DELLINGER BARNEY (Boston): I think Dr. Randall's investigations have been most illuminating and have been rather more acute than those of almost everybody else. What he says about the possibility of a prostatic origin of genital tuberculosis, I think, as he already said, I have admitted is true in a great many cases. One naturally softens a little as he grows older and I am thinking as I go along with these investigations that there probably is a good deal in what Gambarini said, that in the present state of our knowledge we cannot say with utmost assurance which is the primary source in a great many cases. I still cling to my original thesis, however, and the reason I do is because it seems to me if these cases which Dr. Randall has reported were common in life that we would recognize them clinically much more often than we do. I do not know the exact number of cases of primary prostatic tuberculosis that have been reported clinically, but I think they can be numbered on the fingers of one's hand; they are very rare, as far as I know. Of course somebody may say that they are more common and that we do not recognize them. It seems to me we would.

Autopsies very frequently are misleading in this respect in that they show tuberculosis of organs that are involved because of terminal conditions. I can quote several autopsies where all the organs but the prostate were involved in tuberculosis and where epididymitis had gone on for some period of time.

It is impossible, also, to refute the known fact that after removal of one or both epididymes these prostatic and fascicular lesions do quiet down and disappear; that is well known, and I do not see how any findings such as Dr. Randall has given us can get around that fact. Then also it is known that the prostates and vesicles of children are by no means as frequently involved as those in the adult. Just exactly what the significance of that is I do not know, but we not infrequently find children with a perfectly normal prostate and vesicles.

DR. ALEXANDER RANDALL (Philadelphia): My old plaint is not that any point of the genital tract is primary. I do not see why

we should look for a primary source. There is no reason why any portion of the genital tract should not be the primary source. Now, as regards the primary lesion in the prostate, Lehman, as I quote in my article, cites nineteen cases in his studies and I imagine, if the literature is totaled, that Dr. Barney's fingers will have to be increased considerably.

PRESIDENT'S ADDRESS

DAVID W. MacKENZIE, M.D.
Montreal, Quebec, Canada

Fellow Members of the American Association of Genito-Urinary Surgeons: It has been my privilege and honor as President of this Association to meet all assembled here. May I express the hope that our conferences and exchange of ideas may result in great and enduring value to us as individuals and to the constituencies we represent. Much has been achieved in our particular field; vast progress has been made in past years; much remains to be accomplished, and gatherings such as this have always been, and always will be, notable milestones in our onward march to our objective.

That the presiding officer of your organization, meeting in Pennsylvania, is a Canadian, on the staff of a Canadian University, is very significant evidence of the international character of our efforts. Scientific research and surgical discovery know no boundaries. They are not limited by racial or national barriers. The benign stream of medical knowledge, so often the result of sacrifices and toil, passes freely from one land to another, to bring with its healing waters comfort to all in distress. It is retarded in its flow by no tariff obstacles. It is the greatest example—perhaps the one great example—of real internationalism at its best, the striving together for the common good, irrespective of geography or color or tongue, the earnest coöperation and unselfish exchange of willing effort for the welfare of humanity in all lands. It was commanded long ago by the greatest peace-maker the world ever knew, "Go ye into all the world and preach the gospel," the gospel of service, "to every creature." I think it is no exaggeration to say in all humility that medical science has striven in its own field to obey that divine order and to bring, throughout all the world, relief to suffering mankind. That is our ideal; that is the gleam which our great predecessors so faithfully followed; and we are endeavoring to continue their work. We must do all we can to encourage young

men who have achieved results in special research by giving their work prominence on our programs. We are to be congratulated on the excellence of our present program and we are grateful for the generous response of our members who have contributed such a rich variety of papers.

I regret very much, perhaps for selfish reasons, that we could not hold this meeting in Canada, but I am sure it is a pleasure and a privilege for us all to meet in this old historic state of Pennsylvania, with its immortal memories of great and gallant spirits; its revered traditions; its capital city with its foundations, as its name implies, based upon love and brotherhood. Here tolled the Liberty Bell, the toxin that sounded the death-knell of political oppression. Here sounded many a peal of triumph and victory over the forces that retard human welfare and human happiness. And here, we trust that we, too, may have helped in our days of discussion to relieve another dire oppression—the oppression of human pain.

I cannot vacate this chair without expressing a word of gratitude for the good-will and harmony that have always existed between our countries in the endeavor to realize our common ideals. We in Canada owe more than we can estimate to the Carnegie and the Rockefeller Foundations. We are grateful for the daily evidence of your kindness and your help. May we continue our efforts with a single purpose, that in our researches what is yours is ours and what is ours is yours. It is that spirit of coöperation which will cause those to whom we minister, now and forever, to rise up and call our Association blessed.

I wish to express to you all, especially the older members, my sincere thanks for your loyal support throughout my term of office. I am deeply grateful to our Secretary, Dr. Sanford, whose efficient work made my task so easy. My term has been a happy and profitable experience, and I bespeak for my successor the same cordial sympathy that was mine.

I congratulate you on your selection of officers for the coming year and Dr. Kretschmer, as President of such a splendid lot of fellows. Gentlemen, your President, Dr. Kretschmer!

PRESIDENT-ELECT KRETSCHMER: Gentlemen, may I thank you for the honor of electing me to guide the destinies of your Society

for a year. I am sure that with the aid of Dr. Sanford it will be very simple and very easy.

I know that it will be impossible for me to make a speech such as Dr. MacKenzie has written, either this year or next. I think the sentiments contained in his speech are marvelous and I think it would be very well to include this in our minutes or as part of our transactions. It seems to me this beautiful presentation should not be missed and I think it ought to go in a rather prominent part of the transactions.

DR. HAGNER: Mr. President, I move a rising vote of thanks to our retiring President for the wonderful way in which he has handled the meeting and also for his very poetical address.

PRESIDENT-ELECT KRETSCHMER: A motion to adjourn will be in order.

It was voted, on motion regularly made and seconded, that the meeting adjourn, and the meeting adjourned *sine die* at eleven twenty-five o'clock.